SCIENTIFIC AMERICAN

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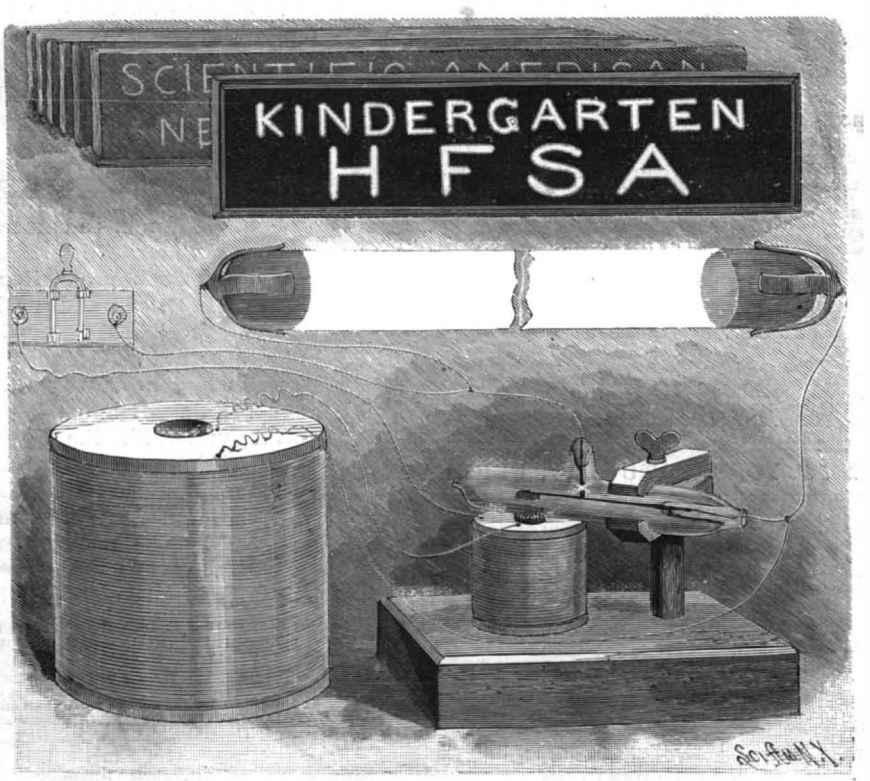
VACUUM TUBE ILLUMINATION BY THE D. McFARLAN MOORE SYSTEM.

The most impressive exhibitions of the power of electricity are those depending on induction. The mere pulling of an armature through space by a magnet, there being no connection between armature and magnet other than that furnished by the theoretical lines of force of the hypothetical ether, only loses its wonder to us because of its familiarity. Again, in the operations of the alternating electric current, we find a particularly rich field for the display of inductive effects. From the induction coil or converter, where, without contact, a current is generated in an independent coil, to the polyphase motor, where, following the lines laid down by the genius of Tesla, an entirely disconnected coil of wire whirls around under the influence of the induction, all is wonderful. The hope of the future is that light may yet be produced in a way less extravagant than that of the incandescent lamp, where the results of an entire horse power of energy are represented by four or five feet of incandescent carbon filament. These hopes are all based on induction, for it is in the utilization of alternating or broken currents that the hope of the future for this thing seems to lie.

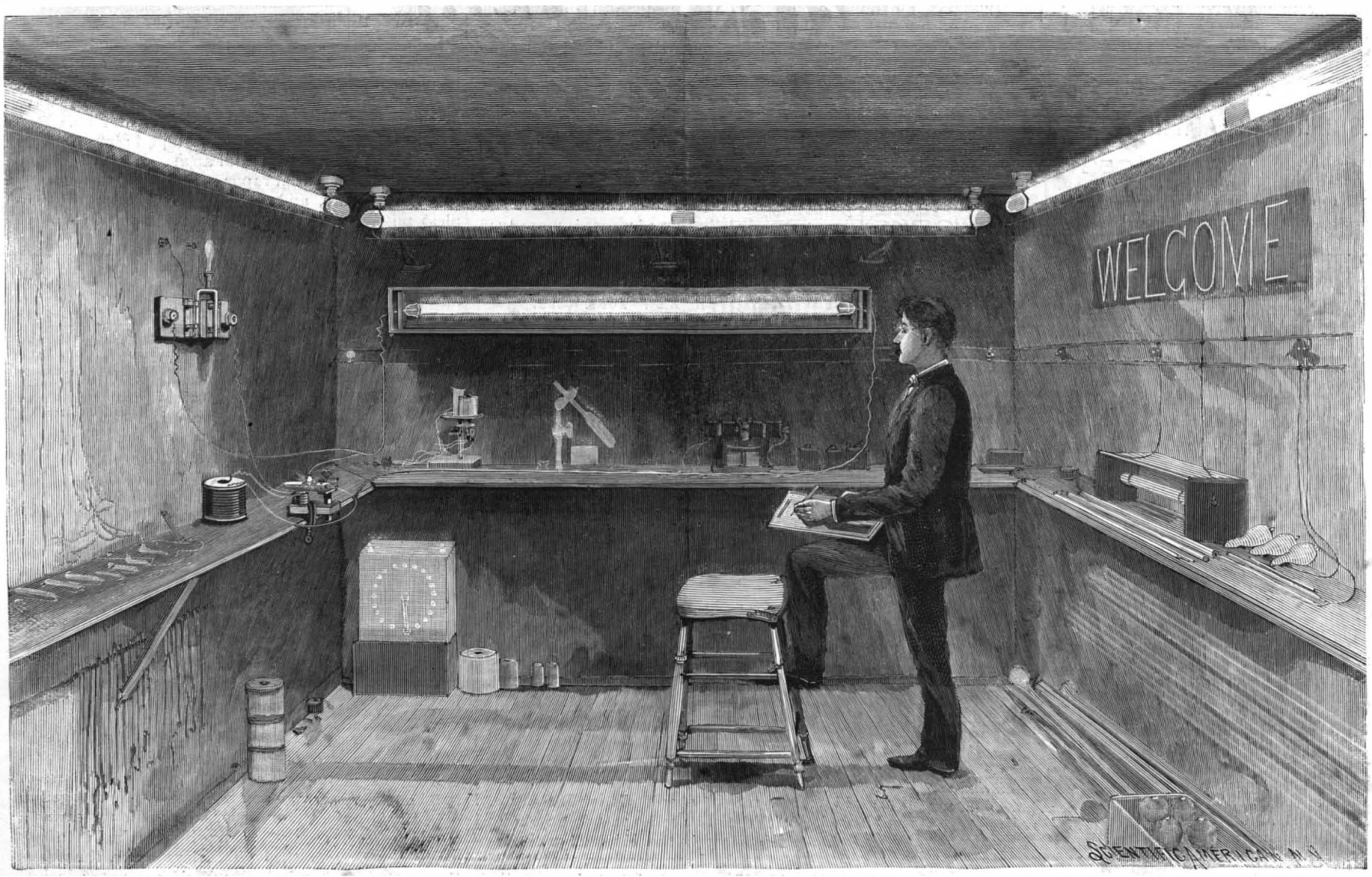
Mr. D. McFarlan Moore, of Newark, N. J., has,

(Continued on page 135.)

LIGHTING TUBES BY INDUCTION.



VIBRATOR, VACUUM TUBE, SIGNS, AND LETTERS.



GENERAL VIEW OF LABORATORY LIGHTED BY VACUUM TUBES.

VACUUM TUBE LIGHTING BY INDUCTION FROM INCANDESCENT CIRCUIT.

Scientific American.

ESTABLISHED 1845.

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NEW YORK, SATURDAY, FEBRUARY 29, 1896.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1052.

For the Week Ending February 29, 1896.

Price 10 cents. For sale by all newsdealers.

SUCCESSFUL GERMAN AND BELGIAN COMPETITION WITH GREAT BRITAIN IN THE IRON TRADES.

There has been a remarkable development of the iron trades in Germany and Belgium in the last few years. The serious inroads which the competition of these countries is making upon fields, both at home and abroad, which were supposed to be firmly controlled by the English manufacturers have stirred up the British trade to make special inquiry into "the methods and conditions under which Continental manufacturers—more particularly those in Belgium and Germany—were enabled to compete so successfully with those in this country (Great Britain), not only here, but also in neutral markets." The delegation was composed of both employers and employed; and its mixed nature—the fact that it was so well qualified to judge the question from the two standpoints of capital and labor—make its findings of special interest, not merely in Great Britain, but in any country which, like our own, is a large producer in the iron and steel trades.

It appears that the cost of raw material, such as coal and pig iron, differs very little in England, Germany, or Belgium; and that it is in the process of manufacture that the Continental firms show such superior economy. The extent to which these nations have been able to underbid the British manufacturer may be judged from the following figures: "In 1882 Great Britain produced 8,493,000 tons of iron, against only 3,380,000 tons produced in Germany. In that year the British produced 5,014,000 tons of finished iron and steel, or about double the output of Germany. Since then, however, the annual German production of pig iron has advanced to 5,380,000 tons, and the output of finished iron and steel to 5,927,000 tons, while the British production of pig iron has declined to 7,364,000 tons, and the British output of finished iron and steel has dropped to only a trifle over 4,000,000 tons; so that Germany is now producing a considerably larger quantity of finished products than is Great Britain. Belgium has not during this period made anything like the same relative progress as Germany, but the output of Belgian steel has, nevertheless, more than doubled during the last ten years, and the capacity of production is now three times what it was in 1880." The report ascribes the rapid development of the iron industry to the "steady character of the workmen," and to the fact that strikes are very rare among the German operatives. The delegation were impressed with "the splendid discipline maintained," and there was a military exactness and regularity in the performance of orders. The visitors were struck with the "splendid physique of the men employed in the works, and not less so with their sobriety and steadiness." This not only insures a larger week's wage to the workman, but the employer "gets the maximum production out of his plant, no heats being lost through broken time, etc."

It appears that, as between England and Germany, there is not so great a difference in the wages as is generally supposed. They are lower in Germany; but on the other hand there is a larger relative number of men employed in a German mill. One secret of their economy is seen in the fact that there are no highly paid head "mill contractors," as in an English mill; the oversight being left entirely to the engineer. As the result of its investigations the delegation report, "the general distribution of wages is more evenly balanced, and we do not find the extremes that obtain among English workmen."

RAPID TRANSIT IN NEW YORK CITY.

We note with pleasure that ex-Mayor Abram S. Hewitt, in his testimony before the Rapid Transit Commission, advocates an immediate extension of the elevated roads on the lines indicated by us in our last issue.

Mr. Hewitt is opposed to the construction of an underground road beneath Broadway, both on technical grounds and because of the unavoidable obstruction to traffic which must arise during its construction. He suggests the Elm Street route as being more feasible. At the same time, he affirms that whichever route be adopted, it will be at least five years before the scheme would be completed and in operation; and that it is imperative that some immediate scheme of relief be carried out to meet the pressing needs of the hour.

"Most of the difficulty," said Mr. Hewitt, "which exists to-day and which will exist during the next five years during the construction of this road would be met by an arrangement between the Rapid Transit Board with the Manhattan Elevated Company for additional tracks and express trains. To-day the most important consideration for New York City is not the construction of the road, but that the existing elevated structures should be strengthened, increased, and put in a condition to move the people up and down town at a rapid transit rate of speed. When I say this, I want it understood that I have no axes to grind and I do not hold a single share in the elevated or the New York Central Railroad. I say, however, that the elevated road should get every facility to increase their means of transportation."

We heartily agree with the ex-mayor in his conviction that the elevated system should get "every facility" in carrying out this sorely needed extension. It seems to us that the question is purely one of expediency, and that it should be judged as such. The improvement of our transportation facilities is a matter of compromise, in which the benefits which will arise from the doubling of the elevated tracks are to be weighed against any inconveniences which might result therefrom. The existing roads are a disfigurement to the streets in which they run, it is true, but the mere addition of extra tracks and strengthening of the existing structures can scarcely make that disfigurement any more complete than it already is; and if the complete removal of one nuisance can be obtained at the cost of a slight increase in some other, common sense would suggest that the change be made.

If, on the other hand, the question is not one of pure expediency, there must enter into it, as Mr. Hewitt's words would suggest, an element of sentiment or prejudice. The elevated system is, or at any rate has been, an enormously profitable investment, it is true; but it has also been an enormous public convenience. If the general public, or the body that administers its affairs, is willing to submit to the present intolerable overcrowding, rather than contemplate a possible increase in the profits of the corporation which serves its needs, and is seeking to serve them more effectually, it is collectively guilty of the sin of cutting off the nose to spite the face—a species of folly which is supposed to be remotely possible in the individual, but never in a collective body of men.

A Large Gun Making Combination.

Several of the largest gun making establishments of the United States have combined to form what is to be called the American Ordnance Company, with Gen. Albert R. Ordway as president. The firms in the agreement are said to be the Driggs-Schroeder Ordnance Company, of Philadelphia; the American Projectile Company, of Lynn, Mass.; the Hotchkiss Company, and a torpedo company of Providence, R. I. It is stated that the Bethlehem Company, of Bethlehem, Pa., and the Gatling Gun Company, of Hartford, are also in the new combination. The company will have its headquarters in Washington, and a big plant for the manufacture of projectiles and guns will be started at once at Bridgeport, Conn. The reason given for the organization of the new company is that the separate companies are unable to cope successfully with the large European establishments, while a concentration of their capital will permit them to do so. The new concern will endeavor to obtain the trade of South and Central America and of the Asiatic governments.

Refinements of Measurements.

Refinements of measurements have gone to almost incredible limits. On lenses curvatures of 1-150,000 inch can be measured. In spectroscopic analysis of mere traces of different elements, fractional wave lengths are read to 1 2,500 millionth of an inch. Professor Dewar in his researches on liquid air attained a vacuum of 1-2,500 millionth of an atmosphere by filling a vessel with mercurial vapor and exposing it to a very low temperature, and Professor Boys, with the simplest possible arrangement of quartz fiber, torsional balance, and mirror, claims to have been able to just detect an attractive force of the 1-20,000 millionth of a grain. So much for minute weights and measures, and as regards angles the Darwin pendulum will indicate a movement of 1 300 of a second, which would be about the angular measurement of a penny piece at the distance of 1,000 miles. It is difficult to realize the minuteness of measurements like the preceding. The smallest gold coin of Great Britain, if drawn out into a wire 1-2,500 millionth of an inch diameter, would be long enough to stretch to the sun and back again ten thousand times, and yet the fundamental mystery of the constitution of atoms and molecules would be locked up in every infinitesimal portion of the length of that minute wire. "For the establishment of a truer and more comprehensive theory of elasticity," write the authors of the last important work on the subject, "we shall probably have to wait until we gain a wider acquaintance with the nature of intermolecular action."—Engineering Mechanics.

DR. MAX WOLF'S method of detecting minor planets by photography is described in a recent number of Nature. He uses a 6 inch portrait lens of 30 inches focal length in his telescope, which gives him a field of about 70 square degrees. To make sure that the trails of the planets are not defects in the plates, two photographs of each region are taken, with an exposure of two hours. A positive and a negative are put together with the films in contact where the trails appear as a continuation of each other. Another method is to look at the photograph through a stereoscope, the planet then appearing in relief. Dr. Wolf has never looked through the telescope at any of the many planets he has discovered by the photographic method.

Patents and Inventions.

The Connecticut Yankee still preserves his pre-eminence as an inventor. For the last few years more patents in proportion to population have been issued to Connecticut than to any other State. At present one man in every 993 inhabitants of Connecticut is an inventor.

It is a remarkable fact that 5,479 patents have been issued for devices used in wearing apparel. Many of them relate to the method of cutting and fitting, while others are concerned with peculiar devices employed to strengthen the material in certain parts of the garment.

Strange to say, the District of Columbia contains a remarkable number of inventors, one to every 1,379 of the population. This state of affairs may possibly be explained on the supposition that many inventors make a temporary home in the District for the purpose of forwarding the interests of their devices.

According to the Patent Office reports, there are 5,014 different kinds of patented beds and lounges on which "tired nature's sweet restorer, balmy sleep," may be courted.

The care of live stock has received close attention at the hands of the American inventor, 3,089 appliances having been devised for the comfort and convenience of domestic animals.

The natives of Germany come next in order to those of England in the matter of taking out patents in this country. The number of patents issued to subjects of the Kaiser is 582.

Massachusetts stands next to Connecticut in the number of its inventors in proportion to population. In the Bay State one man in every 1,335 of the population patents something every year.

That music hath charms to soothe the savage breast of the inventor is demonstrated by the fact that he has taken out 3,928 patents on musical instruments or the various parts thereof.

The bees of America have no reason to complain of neglect, there being 998 patent hives in which the busy bee, that, according to the poet, improves each shining hour, may store up its honey.

The butcher has 978 patents which may be employed or not, as he chooses, in his business. Most of them are devices used in the large pork packing establishments.

The manufacture of India rubber is protected by 1,864 patents.

The young American idea is taught to shoot by means of 793 patents issued upon as many educational appliances. The old-fashioned birch ruler or section of rubber hose used in education is not protected by a patent, and may be employed by any pedagogue.

More patents have been issued from our patent office to British subjects than to the natives of any other foreign country, the number being 689.

Since the invention of the first harvester this implement has been constantly improved, there being no less than 10,155 patents upon it or its parts.

Mississippi stands next to South Carolina in the scarcity of inventions, there being in the former State only one inventor to every 21 857 of its population.

Window shades have received extensive attention at the hands of the inventor, there being 2,435 patents upon them and the devices to keep them in place.

South Carolina patents less inventions in proportion to its population than any other State. There is only one inventor to every 25,581 of its population.

The American farmer will probably be surprised to learn that there are 10,122 different models of plows in the Patent Office, on all of which patents have been issued.

The natives of Canada do not scruple to take out patents in Washington; 296 have been granted by our Patent Office to our cousins on the other side of the St. Lawrence.

The greatest number of patents issued in any one line has been for devices employed in carriages, wagons and other vehicles. The total number of patents in this line is 20,096.

The ordinary reader will probably be surprised to learn that 1,137 patents have been taken out either on different kinds of alcohol or on different devices for its manufacture.

The new woman may choose any one of 1,506 different kinds of crinoline and corsets, all of which have been patented.

The painter of this country is aided by 2,043 patents, covering his paints, brushes and other materials and appliances.

The granger of America need be at no loss for a harrow, 4,691 patents having been issued on these aids to agricultural toil.

On stoves and furnaces 18.340 patents have been issued, covering every part of these indispensible articles of comfort.

The manufacture of charcoal and coke is encouraged by the issuance of 178 patents on the processes or machinery employed.

Rhode Island contains a large number of inventive geniuses, the proportion being one inventor to every 1,753 of its population.

Photography is not so fully represented in the Patent Office as might be supposed, there being only 1,481 patents in this art.

Advertising devices have received much attention at the hands of the inventors, there being 1,922 patents taken out in this line.

The man who loses an arm or a leg, a hand or a foot, has 421 different varieties of artificial limbs or members at his command.

The American housewife ought to make good preserves, for this art is covered by 1,541 patents, either of appliances or of methods.

The annealing and tempering of metals have called for much attention, no less than 736 devices for these purposes having been patented.

The irrigation problem, together with the necessity of having water in every room in the house, has called forth 7,707 patented appliances.

Lamps and their various parts have received much attention from the inventor, there being 8,211 patented appliances in this line of lighting.

The manufacture of the staff of life is carried on by the use of 764 devices employed to make it or used as material in its manufacture.

Every American wears shoes, but not every American knows that 9,348 patents have been taken out on the machinery used in making them.

The processes of grinding and polishing surfaces of metal, stone, wood or glass may be accelerated by the employment of any one of 2,598 patents.

The problem of fencing farm land and city lots has received extensive attention, there being no less than 6,807 patents upon fencing devices and posts.

The vegetables of this country may be cut or crushed in our kitchens by the aid of 2,005 patent machines.

The art of printing is covered by 5,833 patents, either of machines or special devices employed in the work.

The inventors of artificial stone and the manufacturers of lime and cement have taken out 1,159 patents.

The surgeons of this country transact business with their patents by the aid of 3,335 patent appliances.

It seems strange, considering the delicate processes employed in the manufacture of jewelry, that there should be only 1,106 patents in this line.

There is no State or Territory in the Union to some of whose citizens patents have not been granted.

The great department stores and elevators of our cities may choose any one of 1,167 cash or goods conveyors.

The fire extinguisher is represented in the Patent Office by 1,023 different models, each covered by papers patent.

Montana has an unusual number of inventors for a new State. There is one to every 1,738 of its population.

Buttons, buckles and other devices for fastening straps or clothing have been patented to the number of 11,795.

There have been 3,717 patents issued for devices or machines employed by the carpenter.

There are 2,487 different varieties of fire escapes and ladders to be used in emergencies.

Soda water and other cooling beverages are manufactured according to 278 patented methods. The steam engines of this country need not lack for valves, 2,465 of these having been patented.

The Patent Office has issued 3,075 patents for inventions, contrivances, and discoveries in telegraphy. The fisherman has at his command 2,667 patented devices for attracting or capturing the finny tribe.

According to the reports of the Patent Office, there are 4,389 different varieties of patented chairs. The number of patent medicines is not so great as might be supposed, there being only 1,332 in the reports.

Harness making has received the earnest attention of the inventor, there being 7,400 patents in this line. The erection of fireproof buildings is encouraged by 455 patents, taken out for materials or methods.

Over 25,000 inventions for the manipulation of metals have been patented in our government office. Butter making is encouraged by 4,435 patents, either on devices employed or methods of manufacture.

There is no leading country in the world whose natives have not taken out patents in the United States. Woodworking tools have developed 4,235 patents, of which one is an auger which bores a square hole.

Of mechanical motors there are 1,775 known to the officers of the Patent Office. There are 1,351 patents which may be employed in the manufacture of glass.

Kitchenware, exclusive of stoves and ranges, is protected by 1,747 patents. Patent needles and pins are made to the number of 175 different varieties. The manufacture of sugar and salt is carried on by the aid of 2 401 inventions.

The necessity of preparing tobacco for the consumer has developed 2,274 patents. There are 3,307 patents for machinery or processes employed in paper making. The farrier is aided in his work by the inventor to the number of 1,234 patents.

The implements and materials used in buildings are protected by 7,792 patents. Trunks, valises and bag-gage contrivances generally are protected by 1,323 patents. There are 636 patented fuel or methods of preparing wood, coal, and coke for use.

Over 16,000 patents have been issued for the various kinds of electrical appliances. There are 1,771 patents on the mechanism employed in sinking of artesian or oil wells. Railways and railway appliances are represented in the Patent Office by 8,334 models. The miller of this country is aided in his toil by 9,720 devices, all covered by patents.

The American mind may be amused by 4,453 different kinds of patented games and toys.

Inventors of military accouterments, harness and the like, have taken out 435 patents. The dentists of this country have at their command 1,283 patent instruments or processes.

The builder has a choice of 596 patent cranes or derricks with which to do his work. There are 1,549 machines or devices for the manufacture of cordage, twine and string. The manufacture of stationery may be carried on by the aid of 4,532 patented machines.

The American roof may be covered by any one of 665 patent roofings. For the propulsion of steamships 1,583 appliances have been patented. There are 2,298 different contrivances for the purpose of spinning thread.

Knives, forks and spoons are protected by patents to the number of 2,103. There are 5,883 models of different kinds of steam boilers in our Patent Office. There are patents for scrubbing brushes and brooms to the number of 3,184.

There are over 50,000 patents which in one way or another benefit the farmer.

There are 4,854 patents for the manufacture of furniture other than chairs. New Jersey has one inventor to every 1,557 of its population. There are 2,188 tools used, or which may be used, in stone working. Patents on explosives have been issued to the number of 500.

The builders of tall houses have 1,639 elevators to choose from. Papier mache goods have been patented to the number of 3,381. Of air and gas engines, 1,025 different varieties have been patented. Cannons, guns, pistols, and projectiles are protected by 268 patents. One thousand and ninety patents have been issued for paving.

There are 4,240 models of patented pumps in our Washington office. Watch and clock making is encouraged by 3,640 patents. There are 1,449 different appliances for drawing wire. Arkansas has one inventor in every 19,792 of its population.

There are 2,266 patents and models of sheet metal wire. There are 5,979 patent locks and latches for doors and gates. There are 4,299 different kinds of saws and sawing apparatus. North Carolina has one inventor to every 18,597 of its people.

The Patent Office has issued 7,633 patents on laundry appliances. There are 2,388 different kinds of velocipedes. The manufacture of gas is covered by 3,000 patents. The manufacture of felt is covered by 771 patents. Patented machines for bookbinding number 2,566. Boat builing patents number 1,216. There are 1,580 patented knitting machines. The steam engine is covered by 8,237 patents. There are 1,523 different patented kinds of nails. There are 459 patents covering masonry work.—St. Louis Globe-Democrat.

The Valuable Dogwood.

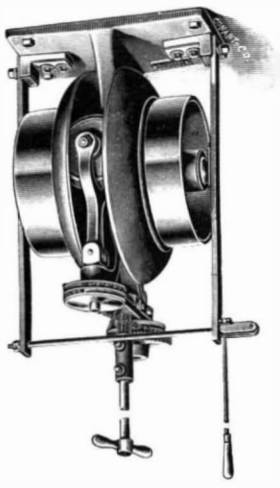
Dogwood wands make excellent whipstocks and are used in some of the best whips. They are cut sometimes by coachmen in the suburbs and sent to town to be dressed and made up into whips. The stocks made of this wood are notable for their ornamental knobs at regular intervals, which are the truncated and rounded branches. These are imitated in some other whipstocks, but the imitation is a cause of weakness. The dogwood stocks are extremely tough and elastic, being comparable in elasticity with whalebone. The wood is used for butchers' skewers, and some philologists conjecture that the first syllable of the name is a corruption of "dag," meaning a spine or dagger. Dogwood, being particularly free from silex, is used by watchmakers and opticians in cleaning watches and lenses. The American Woodworker adds: Bitter bark of the dogwood is used as a substitute for the bark of the Peruvian quinine tree. Dogwood is notably of slow growth, and in all thickly peopled regions the tree is recklessly despoiled for the sake of its blossoms, so that the supply of the wood for commercial purposes is not large.

FEW people realize the immense power that is required to propel a vessel of any kind when a speed above 20 knots is required. Take, for instance, the British torpedo boat chasers, which are mere racing machines, even from a naval point of view. The most perfect specimens of vessels of this class, which have attained 30 knots speed, carry 60 tons of coal, which is full one-quarter of their entire seagoing displacement. They burn 3½ tons of coal per hour. To attain the 3 knots over 27, which is the highest speed of ordinary torpedo boats, it was necessary to increase the fuel expenditure fully 50 per cent.—Marine Review.

AN EFFICIENT SPEED CONTROLLER.

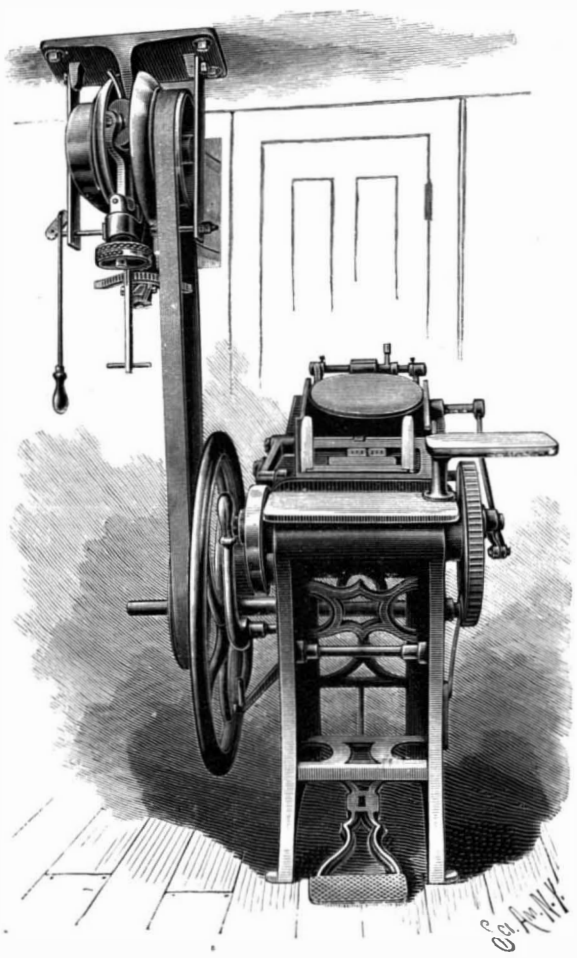
The speed controller shown in the illustration is designed to take the place of and supersede the old style cone countershaft, giving in its place a controller much more compact in design and having for its peculiar advantages the facility of changing the speed to any desired rate within its scope, even to the fewest number of revolutions. This is effected without loss of time on the part of the operator or the touching of the belt, but simply by turning a lever from right to left, or left to right, as he may wish to increase or decrease the speed of his machine, thereby avoiding all danger from accident incident to handling the belt or soiling the hands from coming in contact with it.

This controller can be successfully applied to all machines now in use when it is particularly desirable to obtain the intermediate rates of speed which occur between the steps or risings of the cone pulley, and meets a demand which has existed since the cone system has been known. It has been thoroughly tested during the past three years in actual everyday shop and factory service in the running of printing presses, winding, screw, grinding and knitting machines, drills, lathes, and film machines, and has elicited high commendation and duplicate orders from those who have used it.



THE CUMMINGS' SPEED CONTROLLER.

The belt pulley, receiving motion from any suitable driving or countershaft, has connected to it or forming part of it a concave annular grooved face to be entered by one or more shiftable friction disks, a similar friction face being connected to or forming a part of the belt pulley of the machine to be driven, and the lateral movement of the lever which regulates the position of the contacting points of the disks with the two friction pulleys adjusts the speed of rotation of the driven pulley. It is patented by Henry H. Cummings, and is manufactured as represented in the illustration by H. H. Cummings & Company, No. 110 High Street, Boston, Mass. It can be and has been made to operate automatically with complete success when desired, a feature which constitutes a very important peculiarity of the device.



CUMMINGS' SPEED CONTROLLER APPLIED IN RUNNING A PRINTING PRESS.

Chinese Labor and Wages.

T. R. Jernigan, United States consul at Shanghai, has made a report to the State Department in which are presented in detail the amounts of wages paid in that country for skilled labor. The sums are stated in American currency, and the wages may be understood as with food except in cases where asterisks are used:

Description.	Per Day.	Per Month.
Blacksmith	$0 13	....
Brassworker	16	....
Barber	3	....
Bootmaker:		
Native	10	....
Foreign	....	$5 28
Bamboo cabmaker	11	....
Bricklayer	10	....
Compositor:		
Native	....	5 28
Foreign	....	$7 92 to 15 84
Carpenter	11	....
Cabinetmaker	11	....
Coolie*	13	....
Bookbinder:		
Native	....	4 22
Foreign*	....	6 34
Lithographer*	....	10 56
Furniture polisher	21	....
Tailor:		
Native	10	....
Foreign	....	6 34
Pressman	....	6 34
Coachman:		
Native	...	3 17
Foreign	....	6 34
House Boy:		
Native*	...	2 11
Foreign	....	4 75
Cotton mill machinist*	$0 11 to 22	....
Cotton factory hands*	18	....

Cutting a Gasket.

The inexperienced engineer who tries to cut a gasket by first marking it out with a rule and dividers and then spaces off and lays out the holes is very clearly "not in it" with the man who understands his business, says Tradesman. That man will not try any measuring or spacing business, but will place the sheet of rubber on the flange it is to fit and with a small round-faced hammer he will go lightly over each line of surface boundary, both curved and straight. He will tap lightly so as not to strike through the rubber cloth and damage the iron work, yet the blows are heavy enough to cut the fabric nearly if not quite in two. If there are several holes or a more or less complicated outline to be cut, he will first cut one or two of the bolt holes, then put bolts or tightly fitting pieces of wood in the holes cut to hold the gasket in place while he is cutting the balance of the way around. In this manner the gasket is cut out exactly to the shape of the surface upon which it is to be placed, and that, too, without the trouble of measuring, using dividers or maintaining a knife sharp enough to cut rubber. The only requirement is to strike light with the hammer, so as not to injure the corners of the iron.

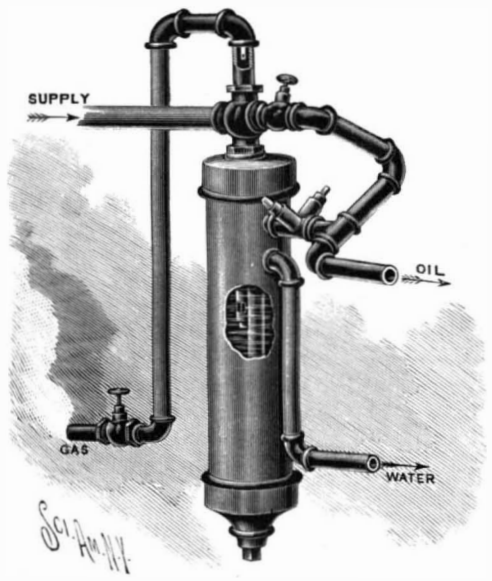
Fall of a Glacier.

Engineering describes the fall of a glacier in the Bernese Oberland about 5 A. M. on September 11, 1895, from an altitude of 10,823 feet above sea level. The whole mass, estimated to be half as large again as the largest of the pyramids of Egypt, leaped down 4,600 feet to the bottom of the valley, then up 1,300 on the other side and back into the valley just far enough to not destroy the watercourse through it. It appears to have jumped the watercourse, moving as a solid mass. It only took about twenty seconds in its first downward plunge, ten in its leap upward, and ten in falling back, so that at the end of forty seconds the mass had changed its place from near the top of the mountain to the farther side of the valley, where it buried nearly one square mile of rich pasture to the depth of six feet. A similar ice avalanche is recorded as having occurred at the same spot on the same day of the year in 1782.

SEPARATING GAS AND WATER FROM OIL.

The separation of gas and water from oil as the latter flows from a well, and before it has reached a tank, is designed to be automatically effected by the separator shown in the accompanying illustration, the improvement making it possible to dispense with a great deal of the tankage room heretofore required, and saving expense and labor for steam. A patent has been granted for this invention to Benton Gilmore, of Deerfield, Pa., and the improvement is being introduced by F. A. Wood, of Grand Valley, Pa. The upper end of the cylindrical body of the device is closed by a cap through which a tightly fitting tube passes down to nearly the center of the cylinder, and on the tube, above the cap, is a four-way fitting forming a confluent chamber, one arm of the fitting being connected with the supply pipe from the well. An upwardly extending pipe is curved and leads downward at one side, forming a gas delivery pipe, while opposite the supply pipe leads a pipe having a check valve, and connected by a union with a branch pipe, preferably made up of fittings, so that it may be given any desired inclination, and the latter pipe is connected with an oil outlet from the body of the device.

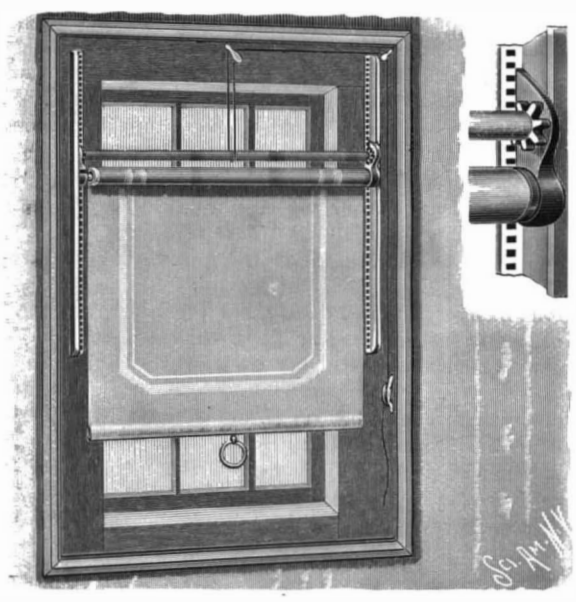
The oil outlet is a four-way fitting, and, by removing the plugs from one of the arms, one may observe the flow of oil through the outlet or main arm. The pipe opposite the supply pipe is not employed when the well flows water as well as oil, and in the upper portion of the gas delivery pipe is a reducing nipple, below which the pipe forms a gas chamber, preventing any escape of oil in case of a heavy flow. The lower end of the pipe extending down into the cylinder from the top is plugged, and has adjacent apertures, forming a separator, and just below the oil outlet is a water delivery pipe whose inner end extends nearly to the bottom of the cylinder. In operation, the gas received from the supply pipe is designed to pass off from the fitting at the top, through the gas outlet, the water and oil passing together through the separating chamber, and each, from their differences in gravity, passing out by their respective outlets.



GILMORE'S SEPARATOR.

AN IMPROVED SHADE SUPPORTER.

The shade-supporting device shown in the illustration is adapted to sustain a shade roller adjustably in position at any desired point on the window frame, thus making it convenient to admit light from the top of a window only when such arrangement of the shade is preferred. The improvement has been patented by Joseph W. Turnbull, and is being manufactured by Turnbull & Hennessy, No. 308 Baronne Street, New Orleans, La. Rack bars, on which are vertical guideways, are secured to the side rails of the window frame, and in these guideways slide bearing blocks in which are journaled the ends of a transverse shaft, gears at the ends of the shaft engaging the rack bars. One of the bearing blocks is shown in the small view, and these blocks, in connection with the shaft, form a supporting frame in which is journaled the shade roller. The shade supporter is drawn up or lowered by means of a cord passed over pulleys at the top and one side, the end of the cord being secured to a retaining device at one side. As the supporting frame and shade are raised or lowered they are guided by the engagement of the slide blocks and the teeth of the gears with the rack, the shade being unwound or wound to properly shade the window after the frame has been adjusted to the desired position. A slot in one of the slide blocks at one side permits the ready removal of the shade from its support. The shade cannot fall under any circumstances, the device is inexpensive and may be readily put up by any one, and the shade is at all times held perfectly level.

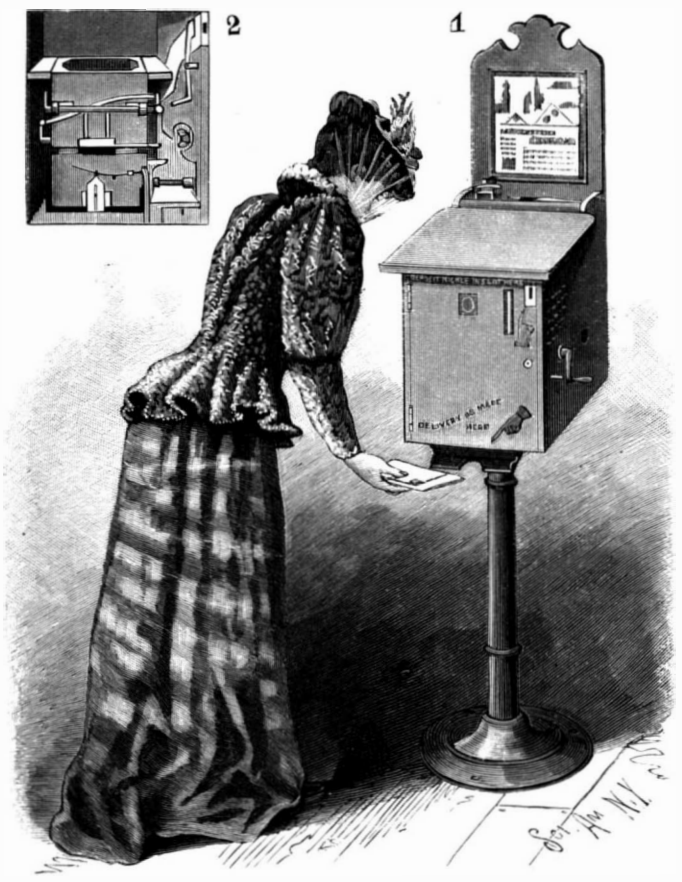


TURNBULL'S SHADE SUPPORTER.

AN AUTOMATIC VENDING MACHINE.

A slot machine designed to afford unusual facilities for vending a wide variety of articles, particularly such as are commonly supplied in elongated sized packages, is shown in the accompanying illustration, and has been patented by Charles W. Goldsmith, of New York. It is now being introduced in many places throughout the city. As shown in the illustration, the machine is arranged to deliver stamped envelopes and note paper of different kinds, various samples of which are shown in the vertical glass-covered case at the rear, the top of the machine casing being formed for use as a desk. The merchandise receptacle, as shown in the small view, is sustained centrally in the casing, and projections therefrom form bearings for rock shafts which operate frames to deliver the goods, a single package at a time, the mechanism being set in operation by a lever, an arm of which projects into an orifice of the coinway.

When the merchandise with which the machine is supplied has been exhausted, a stop lever comes automatically into operation to close the end of the coinway and prevent the insertion of additional coins. The machine, as manufactured, is easily operated, and does not seem liable to get out of order. The merchandise to be delivered, on the insertion of the proper coin, drops from the central receptacle through a guide, falling upon a chute, by means of which it is passed out through the delivery opening.



GOLDSMITH'S COIN CONTROLLED VENDING APPARATUS.

RECENT OBSERVATIONS OF MARS.

—An American astronomer wishes to speak to you, sir. There are two visitors, and here are their cards:

"Percival Lowell."—"Alvan Clark."

—Ask them to walk in.

—I am highly delighted to meet you, Mr. Lowell. We are familiar in France with your splendid work. Have you come to see a little of Europe?

—I arrived this morning at Saint Lazare station and shall be off again from Lyons station.

—What, so soon? The Americans are always meteors!

—I am going to the Sahara to find out whether there is a particle of atmosphere that is perfectly calm; but, in the first place, I am anxious to show you what we have already accomplished upon our Arizona Mountains. It was your work upon the planet Mars that gave us the impetus; but we no longer agree with you. You will utter a loud protest, perhaps?

—On the contrary, dear sir. You well know that I am looking for progress only, and no one was as happy as I to see you dedicate a special observatory to our friend the planet Mars. You know that independent science receives but little support in France. On the contrary, you make quick progress in your country. Have you anything new? So much the better. Mr. Alvan Clark is the leading optician of the world, and he must have constructed a perfect instrument for you.

—Yes; as you remark, a perfect one.

—And of what dimensions?

—Of seventeen and a half inches diameter.

—At what altitude are you situated upon Flagstaff Mountain?

—At seven thousand, two hundred and fifteen feet. The atmosphere is excellent and the images are of perfect distinctness. We have been able to carry our magnifications up to 800 and 900 diameters.

—Mars transits at about thirty-eight million miles, but you have diminished its distance to forty-eight thousand miles, and even a little less. That is five times nearer than the moon seen by the naked eye. And you have seen . . .? I believe you in advance.

—No; you are much too academical, and, I shall dare to say, timorous. You are afraid to cut loose from the leading strings of the school.

—Do you think so? Ask the astronomers of the Institute what they think of it.

—You are stopping by the way.

—That is in order to afford you the pleasure of going further.

—Well! the famous canals, you know. Of these you have but 79 upon your map, while we have 183, that is to say, 104 new ones. Several are as fine as hairs. And your lakes! We have 45 of these, almost all of which are exactly round. And as for the changes that you have described, they are not inundations.

—What then?

—All that is vegetation.

—And our seas?

—Prairies.

—And our lakes?

—Oases.

—"However," added the able observer, "I also have written a book about Mars, and have brought you the proof sheets of it, along with an impression of the new map. You will conclude, as I do, that these are not seas here, since they are traversed by the so-called canals."

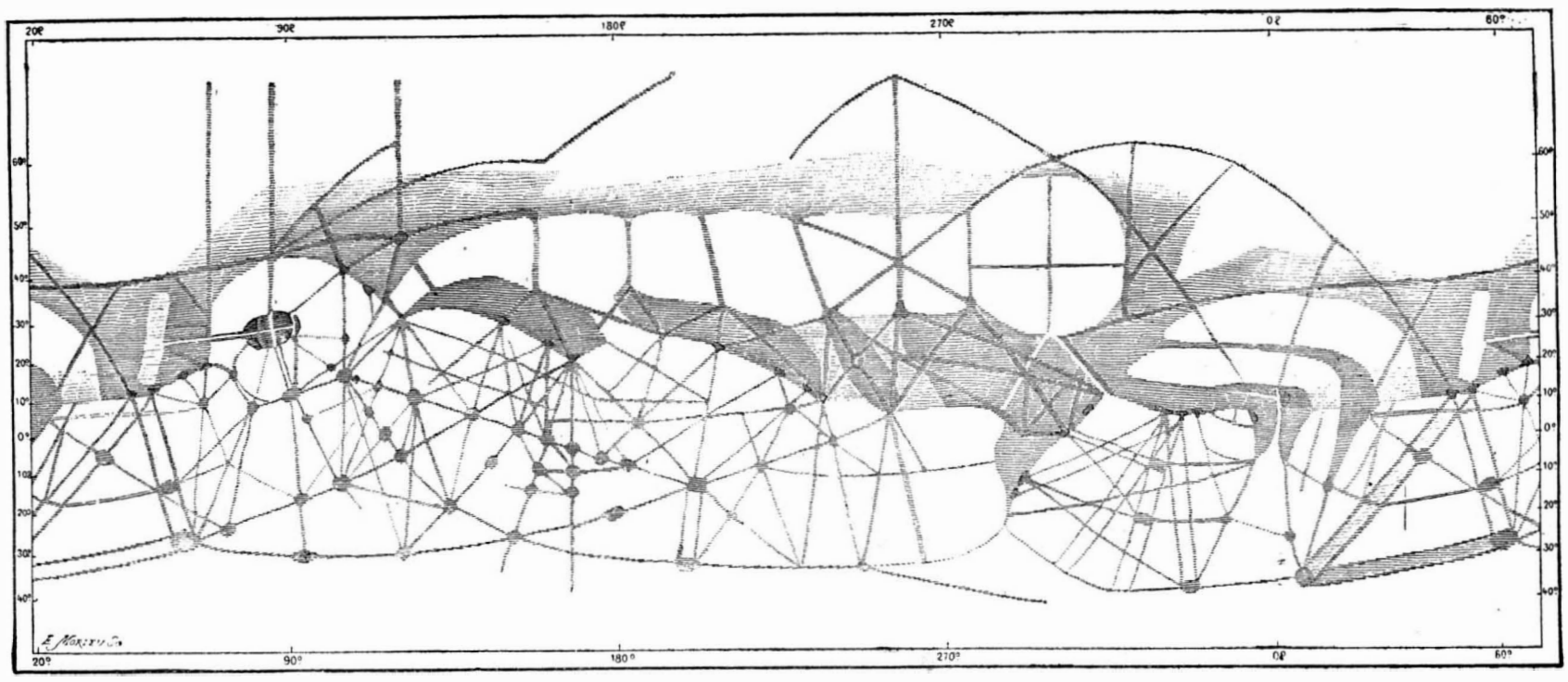
And Mr. Lowell unfolded before my eyes the map that is reproduced herewith.

—This is very remarkable. But are you sure of the accuracy of your observations? At the limit of visibility, one may be the victim of illusions, and even afterward see again what he thought he saw the first time.

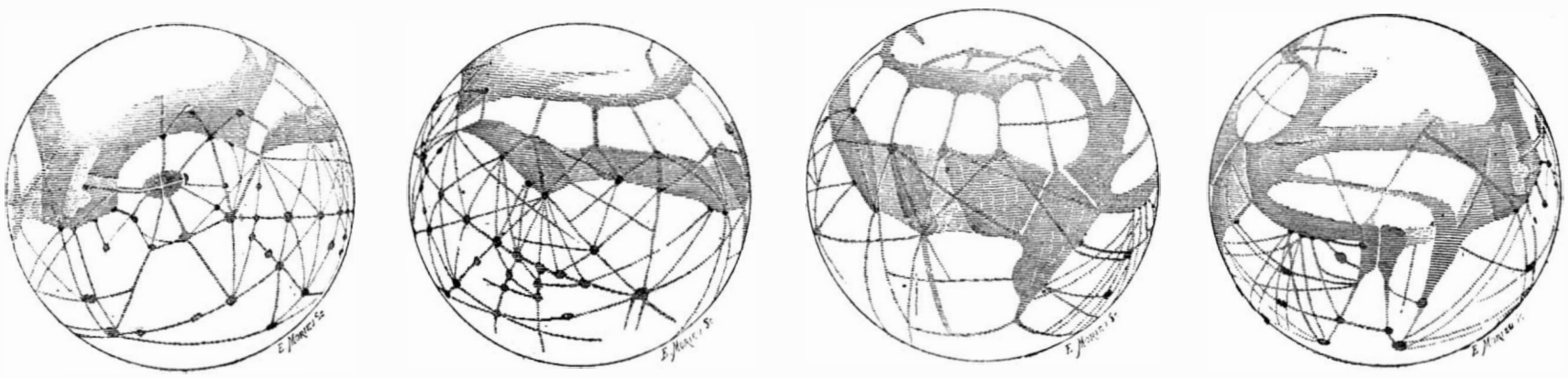
You know as well as I that the dumbbell figure, for example, drawn by Cassini two centuries ago does not exist, and yet every one thought he saw it.

—Mr. Pickering and Mr. Douglass, like myself, are perfectly sure. And now we confidently submit our observations to the criticism of astronomers. I call your attention especially to the geometrical pattern of the canals. See these meeting points. This arrangement is intentional and is for the express purpose of draining off the water.

The conversation between Mr. Lowell, Mr. Clark and myself upon this interesting subject expanded. I was not far from admitting (and I have already written) that we do not truly see the canals. All those who



NEW PLANISPHERE OF THE PLANET MARS.



FOUR TELESCOPIC ASPECTS OF THE PLANET MARS.

have had the unspeakable pleasure of traveling in a balloon and of hovering at a certain height over rivers have remarked that the latter are reduced to a mere thread, but that their course is admirably traced by the verdant valley that they water, the meadows outlining such course on both sides. One day, at six o'clock in the morning, while I was at an altitude of 8,000 feet above the Rhine at Cologne, I was much surprised at the tenuity of the river, which was scarcely visible as a green thread in the center of its meadow, which, likewise green, was elongated like a ribbon from south to north. I had the same impression one day in passing over Orleans at an altitude of 10,800 feet above the Loire, when the water was even invisible, and it was the bottom of yellow sand that was seen like a central thread of the strip of meadow land. In the canals of Mars, it is also the product of the water that we see; the vegetation and not the canals themselves.

As for the seas, we ask time to reflect until the month of December, when the planet will return to us, in obedience to the laws of attraction, and permit observers to confirm the lines of this new map. If these dark lines really traverse the seas as they do the continents, we shall be led to modify our interpretation and to no longer consider them as stretches of water.

Nevertheless, there is water upon this neighboring globe. The most evident proof of this is in the snow that extends all around the poles as far as to a latitude that corresponds to that of St. Petersburg, and sometimes even to that of Paris, and which, under the rays of the summer sun, melt almost completely. This melting of the circumpolar snow is much more complete upon Mars than upon the earth; doubtless because the seasons, which are analogous to ours, are twice as long. None of it remains except at one point —not at the geographical pole, but at the pole of cold, at 210 miles from the former. Whence is this water derived, and what becomes of it?

We know what becomes of it. It fills the canals and is distributed over the entire surface of the continents for the irrigation of the dry land. It never, or scarcely ever, rains upon Mars. Fine weather is perpetual there. There are no clouds, no rains, no springs, no brooks and no rivers. The circulation of the water takes place in an entirely different manner from that in which it does here.

According to these recent observations, the water derived from the melting of the snow in summer gives rise in the first place to the dark spots that we take for seas, in distributing streamlets of water thereupon that supply the fields and meadows, and perhaps the woods, the tone of which varies with the seasons. Then it is sent by the geometrical network of rectilinear canals to the most desert steppes.

The series of disks arranged in echelons at the intersections of the canals represent purposely created oases fed by these waters.

We know that upon this neighboring world a man weighing here 165 pounds would weigh but 52, that the density of substances is much less there than here, that the atmosphere is very light there, and that the conditions of life there all differ very sensibly from our own. It is probable that the human kind, whatever it may be as regards form, is more advanced than our own (Mars being much older than the earth) and much superior in intelligence. Such fraternal unity of organization would seem, moreover, conformable to our theoretical ideas as to our neighbors of the sky.

Optics is rapidly advancing and will continue to advance. Let us not draw conclusions yet; let us wait. But let us testify to the rapid progress of the finest and most attractive of all the sciences. We shall expatiate no further upon this subject. We shall merely add that Mr. Lowell was kind enough to postpone his departure in order to deliver a lecture before the Astronomical Society of France, and that it proved a great success. This session, which was presided over by Mr. Max Cornu, was particularly interesting. Do you ask me what the Astronomical Society of France is? It is an association of which all those who love astronomical science may form part, in consideration of ten francs a year, and which, through its monthly bulletin, keeps one posted upon all the progress made in astronomy.

We reproduce herewith four globes representing the planet Mars in its entirety, according to Mr. Lowell's observations. The American astronomer has laid out a planisphere which we likewise reproduce. This represents these same globes extended upon a plane according to the Mercator system of projection, used in geography for the construction of charts.—Camille Flammarion, in L'Illustration.

Opposition to Inventions.*

One of the most remarkable things in the history of mankind is the opposition to the introduction of inventions and improvements which has existed from the earliest times, and still exists to some extent.

From the time when the earth was believed to be flat, and Galileo was denounced and imprisoned for asserting, in accordance with the theory of Copernicus, that the sun was the center of the planetary system, and that the earth had a diurnal motion of rotation, this opposition to new ideas has existed, and been manifested in the grossest outrages upon, and persecutions of, the originators and advocates of the new ideas. This has been true of inventions and improvements in the arts and sciences, as well as in governmental and religious improvements or reforms.

Much of this was due to the existence of the prevailing doctrine of the "divine right" of rulers and the arbitrary power exercised by them, and to the claim of superior wisdom and infallibility made by the then dominant church, supplemented and rendered possible by the ignorance and helplessness of the masses.

Besides, human nature seems to be subject to the same laws as moving bodies; it moves always in a direct line when once set in motion, unless interfered with by a power sufficient to deflect it from its course. In the arts and sciences, as in politics and religion, men prefer to remain undisturbed, and naturally resent any interference with their settled beliefs and habits. They look with suspicion on new suggestions or ideas, and especially such as, in their ignorance, they think will interfere in any manner with their present interests; and hence the tendency to continue in the old ruts, and violently oppose improvements or changes, and to denounce inventors as "cranks."

History shows that the great improvements in the arts and sciences have had their development only since free governments have been established, and general education introduced; and it is where these exist in the greatest perfection that the greatest advance has taken place.

In the United States, where there is the greatest freedom in governmental and religious matters, there has been the greatest advance in inventions. The growth and development of our manufacturing and agricultural interests, which is due to inventions fostered by our patent system more than to any other cause, have been marvelous, and excite the astonishment of the world. Under the benign influence of this system, in a single century, we have grown from a cluster of scattered settlements, mostly along the Atlantic seaboard, with a population of less than 4,000,000, to a powerful and compact nation of nearly 70,000,000; have increased our national territory from 830,000 to 3,314,220 square miles; have subdued the forests and built up the whole country from ocean to ocean; and have built more miles of railroad, and established more post offices, than all other nations combined. We have grown and prospered as no other nation has, until to-day we do one-third of the world's manufacturing, one-third of its mining, one-fifth of its farming, and possess one-fifth of its wealth.

With such an illustration of the benefits of our patent system, one would suppose that opposition to inventions would long since have ceased; but, unfortunately, while it has greatly diminished with the growth of intelligence and universal education, it still exists.

As illustrative of this spirit of opposition, it may be interesting to cite a few instances. When, in 1807, Papin, of France, the inventor of the digester in universal use for paper making and many other purposes, and also of the lever safety valve, made a small steamboat and ran it down the river Fulda, the ignorant boatmen, who, like some of the laboring men of the present day, thought it would injure their business, seized and destroyed it.

So, too, when Jonathan Hulls patented his steamboat in England, in 1736, he was laughed at and ridiculed in every conceivable way.

When Jacquard invented his loom, which was so wonderful that the great Arnout, French minister of war, caused him to be brought into his presence and said to him: "Are you the man who can do what the Almighty cannot—tie a knot in a stretched string?" there was the strongest opposition to its introduction, culminating in a mob of the silk weavers, who took it from his house into the streets, broke it up, and burned the fragments.

It was the same with Hargreaves in England, when he invented his spinning jenny in 1763. He was persecuted by his fellow workmen, who seized his machine, broke it in pieces, and drove him from his native town.

That invention, with the improvements of Arkwright and Crompton, and the invention of the cotton gin by Whitney, who was outrageously defrauded of his rights, have changed the entire art of producing woven fabrics. Indeed, so far as the cotton industry of the world is concerned, they may be said to have created the industry, which to-day gives employment to millions, and has so immensely cheapened the product that it is used the world over.

This opposition to and unbelief in the possibility of the success of inventions has not been confined to the ignorant alone, but has been shared by many educated and even great men. When it was proposed to build a railroad in the United States, Chancellor Livingston, one of the greatest men in the State of New York, published a letter in which, as he thought, he demonstrated the utter impossibility of the proposed undertaking. His reasons were, first, that it would require a massive substructure of masonry the whole length of the road, and that would be so expensive that it would not pay; second, the momentum of such a moving body as a train of cars would be so great that the train could not be stopped until it got several miles past the place; and, third, no one would want to risk his life flying through the air at the rate of 12 or 15 miles an hour.

So, too, Daniel Webster expressed grave doubts as to the possibility of railroads, saying, among other things, the frost on the rails would prevent the train from moving, or from being stopped, if it did move.

When Murdoch invented or discovered a means for producing illuminating gas, no less a man than Sir Humphry Davy ridiculed the idea of using it for lighting purposes, and said if it was to be used for street lighting, they would have to use the dome of St. Paul's for a gasometer. Sir Walter Scott made clever jokes about "sending light through street pipes," and "lighting London by smoke," but subsequently had his house lighted by it. Wollaston, a scientific man, said "they might as well attempt to light London with a slice from the moon." It is but a few years since the scientists of Europe demonstrated mathematically that the electric current could not be divided for incandescent lighting, but to-day the contrary is demonstrated by millions of incandescent lights, illuminating every spot where civilized man resides.

But the strangest of all things in this connection is the fact that, even in this enlightened age, there are men who still insist that inventions are injurious. It is not many years since that, in a paper published at the national capital, there was the statement that the steam engine and the sewing machine were two of the greatest curses that ever befell mankind!

It is, moreover, a matter of history that in certain sections of this enlightened land prayers were fervently offered in churches beseeching that the wickedness of the newly invented sewing machine, which, it was supposed, would rob the sewing women of their means of obtaining a living, might become apparent, and its promoters be stricken by a conviction of their wrongdoing in making it, and thus be told by heaven to desist from its manufacture.

This spirit of opposition exists to-day to a greater or less extent among the labor unions, whose members, without investigating the subject, are made to believe that labor-saving machinery deprives them of employment, or at least will lessen their wages, just as the silk weavers of Lyons thought in regard to Jacquard's loom, and as the spinners of Lancashire thought in reference to Hargreaves' spinning jenny.

It is no doubt true that, when a new invention is introduced which revolutionizes some particular art or branch of business, it at first decreases the number of persons employed in that particular line; but that is only temporary, for in a short time the result is a cheapening of the product, a greatly increased demand for it, because of this cheapening, and then necessarily an increased demand for laborers in that line, and almost universally at increased wages.

The statistics of the country show this to be true beyond the possibility of question. The records of the Labor Bureau show that from 1860 to 1880, the most prolific period in this country of inventions, and the most intensified in all directions of their introduction, the population increased 59·51 per cent, while in the same period the number of persons employed in all occupations—manufacturing, agriculture, domestic service and everything—increased 109·87 per cent; and in the decade from 1870 to 1880 the population increased 30·08 per cent, while the number of persons employed increased 39 per cent.

As shown by the investigation of a committee of the Senate, wages have increased 61 per cent in the United States since 1860. And, as all know, during that same period the cost to the people of nearly all manufactured articles has been decreased in as great if not a greater ratio. As with manufacturers, so with farming. As a recent writer has well said, "The use of patented machinery has so changed agriculture that there is more propriety in saying that we manufacture crops than in saying that we grow them." And still another writer says: "We use implements that cheapen the cost of production, and make the labor of harvesting like the sport of the fairy books."

While most people have the idea that inventions have mainly benefited the manufacturing industries, it is susceptible of demonstration that they have benefited our agricultural industries nearly as much.

In speaking of the condition of the United States, a recent English observer says:

"America has for many years enjoyed an amazing degree of prosperity, so much so indeed, that, to use the eloquent words of Edmund Burke, 'generalities, which in all other cases are apt to heighten and raise the subject, have here a tendency to sink it. Fiction lags after truth, invention is unfruitful, and imagination cold and barren.' The United States has 65,000,000 people, who spend more on dress than any other people on the face of the earth," and who, he might have added, enjoy more of the comforts of life in all directions than any other people on earth.

*By Mr. William C. Dodge, in Engineering Magazine.

VACUUM TUBE ILLUMINATION BY THE D. McFARLAN MOORE SYSTEM.

(Continued from first page.)

with relatively simple apparatus, produced very remarkable effects in inductive lighting, and, after some years of work and study, his system has taken a definite shape. Mr. Moore has worked upon the principle of effecting as clean cut and rapid a break of an electric current as possible, and has utilized for lighting purposes the effects of this break upon a current in a self-inductive circuit, recognizing the fact that it was the so-called action due to the break, the inductive "kick," which he had to rely on, and he concentrated his energy on making the break as sharp and as decided as possible.

One of his first systems was the inclosing inside of a Geissler tube of a mechanical circuit breaker for the tube itself, and with this apparatus he obtained very good effects, the tube lighting up much brighter than when actuated in the usual way. The process seemed to lend itself so well to existing conditions that much was hoped for from it, but it has now been superseded. His present treatment of the problem of lighting, for his work tends to that end, has taken the shape of using a special circuit breaker, to make and break a current for actuating electrodeless vacuum tubes no longer inclosing the circuit breaker in the tube it is used for. This circuit breaker is based on the principle that in order to make a sharp break it is essential to remove anything that acts as a conductor between contact point and contact point, the air ordinarily acting as a conductor between the contact points so as to prolong the action. This prolongation of the action is precisely what it is desirable to avoid, the amount of counter E. M. F. is dependent on the length of time required for a single break, and in one of our illustrations we show the very simple apparatus by which it is disposed of. An ordinary spring circuit breaker is inclosed in a glass tube which is hermetically sealed after a vacuum has been produced therein. In the usual type of circuit breaker the air acts mechanically as a damper on the movements of the spring. In the exhausted tube this dampening is done away with, the frequency of the oscillations being increased six times, which effects a step in the mechanical perfection of the arrangement. From the electric standpoint the absence of air causes the make and break to be far more instantaneous than it would otherwise be, the opening required in the vacuo being less than in air.

The circuit breaker is really the critical feature of the system. Its functions are performed in union with apparatus of known and accepted type. Connected to one of the terminals of the magnetizing coil in the circuit breaker is another coil of wire to increase the self-induction. The apparatus is put into the ordinary incandescent circuit.

Electrodeless vacuum tubes, sealed glass tubes with nothing in them, with no metal attached except the metallic paint on the outside, therefore with nothing to burn out, are used to give the light. They are connected either across the make and break or in parallel with the coil. When all is properly adjusted and the circuit breaker is operating to make and break the circuit, the tubes glow with a strong light, uniform from end to end, without striations and without flickerings. It is as if the entire tube was filled with an even atmosphere of light. In the case of a straight tube, it is a glowing cylinder of the diameter of the tube.

In his laboratory in Newark, Mr. Moore has carried out his experiments, and the exhibitions of his light have been very impressive. The direct current incandescent lighting circuit at 110 volts potential is used and is connected directly to the circuit breaker coil and to the other coil placed in series. When the current is turned on, the circuit breaker vibrates, and at once the tubes connected with it glow evenly from end to end, their light being many times brighter than that of the old fashioned Geissler tube as ordinarily operated, there being absolutely no comparison between the two, the Geissler tube giving a mere thread of weak light as ordinarily worked. Around the cornice of one of his experimental rooms, Mr. Moore has arranged four tubes, 1½ inch diameter and 9½ and 11½ feet long. The ends of these tubes are coated with aluminum powder; there is no wire connected with interior of the tubes, and the interior of the tubes is brought to a degree of exhaustion suited for Geissler tube action. In his experiments these tubes may be lighted all at once from the one circuit breaker, or from several, when the whole room becomes brilliantly illuminated. In this distribution of tubes along the cornice a suggestion in a practical way is made, as it is proposed ultimately to illuminate apartments by placing vacuum tubes in exactly such positions. The recognized tendency of the day is toward multiplication of lights, the avoidance of strong shadows and of uneven illumination being desirable in the eyes of the public. In the illumination by tubes carried all around a room, we have what amounts to an infinite multiplication of lights, causing shadows to disappear and the room to receive the equivalent of what a microscopist would call "the light of a white cloud," recognized by eye workers as the most perfect illumination. It is artificial day light without the red glare of ordinary lamps. Normally, the tubes would have their ends connected, but this is not necessary. The most beautiful effects can be produced by induction, as one excited tube will illuminate another if placed near it. One of the illustrations shows an experiment in which tubes held in the hand are illuminated by being brought near a metallic netting, the latter being in circuit with the circuit breaker and coil.

A curious feature of this experiment, itself most impressive, is that the intensity of illumination is greatly diminished in the portions of the tube below the hand, the increase of electrostatic capacity by the body apparently producing this phenomenon. It is obvious that in this illuminating there is an endless range for decorative effects. It is proposed to use it for advertising signs, and it has already been exhibited in this capacity. It can be utilized for theatrical purposes.

How economical the process will be is as yet uncertain. The great loss in all high E. M. F. systems, including a circuit breaker action, is in the arc; great energy being dissipated in the surrounding air. When this is removed and the arc is left working, the economy is enormously increased. There is no question that the tube is economical; the efficiency of the circuit breaker seems now to be the critical point. But the most impressive feature is the compactness and simplicity of the apparatus by which the operations are carried out. The circuit breaker and coil occupy perhaps a quarter of a cubic foot of space, yet suffice for regulating the supply of current for an indefinite number of Geissler tubes, producing with inexpensive apparatus effects hitherto unknown, and only approximated to by the most expensive apparatus.

Laryngeal Tuberculosis.*

I do not take up this subject with the hope of adding anything astonishingly new, but to impress those who treat general tuberculosis with the importance of accurate local diagnosis, as a prominent feature in the prognosis, and to give some few points in recent methods of treatment. It is probable that about one-third of all patients suffering from pulmonary tuberculosis manifest a greater or less degree of laryngeal involvement. Although, according to most authors, the pulmonary involvement is the initial manifestation of the disease, and the laryngeal involvement presents only as the disease develops, still I believe there are many cases in which a careful laryngeal examination may tell us, sooner than any other physical examination, of the approach of this insidious disease.

It is a too commonly accepted fact that, when an examination reveals a healthy pair of lungs, it is proof positive that consumption does not exist, for very frequently in its incipiency the disease is located in the upper air passages, only revealing itself in the lungs after complete systemic infection.

There is a class of cases with which you are all familiar, presenting recurrent attacks of laryngeal cough, occasional hoarseness, associated with general debility, and yet showing no pathological pulmonary condition. However, a careful laryngeal examination will reveal to the trained eye an unnaturally pale mucous membrane, which alone may give us warning of some threatened disease; a little later on a slight infiltration between the arytenoid cartilages appears, with possible swelling of the arytenoids themselves. All of these signs pass away, only to recur in perhaps an aggravated form, and finally we can diagnosticate unmistakable tuberculosis, perhaps, by this time, both in the lungs and the larynx.

The point that I wish to make is that these first suspicious signs should be promptly recognized, and treatment, both remedial and climatic, might prevent the development of the general disease.

The unmistakable signs of laryngeal tuberculosis occurring in their natural sequence are:

(a) Inter-arytenoid thickening.
(b) Pyriform swelling of the arytenoids.
(c) Infiltration of the epiglottis.
(d) Lesions of the vocal cords (both false and true).
(e) Superficial and deep ulcerations, and
(f) Necrosis.

I will say nothing as to the general treatment of tuberculosis, as you are all familiar with its various phases; but the local treatment will often be of great assistance to the patient in preventing deeper infection, in the removal of symptoms, and perhaps in preventing much suffering.

Catarrhal laryngitis rarely becomes tubercular, but it is nevertheless advisable to cure such catarrhal trouble when possible.

Local cleansing sprays are both agreeable and helpful to the patient—such sprays as solutions of boracic acid, bicarbonate of soda, sulpho-carbolate of soda, diluted listerine, Pond's extract, or dilutions of the indicated internal remedy.

In the case of suspected oncoming tuberculosis, but before it is actually present, local laryngeal treatment is neither necessary nor advisable. But as soon as the inter-arytenoid thickening above mentioned shows itself, and through the progressive steps, local treatment becomes of inestimable value. I have seen ulcerations heal, arytenoid swellings diminish, infiltrations decrease, vocal power restored, and painful deglutition cease under appropriate treatment.

For general applications to the larynx sprays are advisable, but for accurate treatment, and particularly in the use of the stronger preparations, the laryngeal applicator is alone allowable. For simple infiltration, no matter where it is found, mild stimulation for the purpose of promotion of absorption is called for. Such stimulants are the sulphate, chloride, and sulpho-carbolate of zinc, carbolic acid, calendula, and glyceroles of various indicated remedies. Reaction should be watched for and noted, and the applications made only so often as is necessary to keep up the absorption, and not often enough to induce irritation. But when ulceration manifests itself, more radical treatment is demanded. Menthol, from 2 to 20 per cent, in benzoinol, is highly recommended and has been of decided use in stimulating the healing process, and is perhaps second in importance for the treatment of ulceration. But lactic acid stands pre-eminently first and is worthy of its reputation. Its application has generally been made directly to the ulcerated spots, beginning with a 40 per cent solution and increasing gradually to 60 and 80 per cent, and often to the pure drug.

Recent researches, and particularly those made by "Heryug," of Warsaw, have proved that the effect of lactic acid is far more powerful after curettement of the ulcerations, and a perusal of a recently published series of 300 consecutive cases treated in this manner adds strength to our belief in its efficacy. In my own work I have had some good results with this treatment, and several cases have maintained the improvement for a period of over two years. The internal treatment I shall not discuss, because each case needs individualization. But in passing I cannot refrain from mentioning with highest praise the iodide of lime. Its sphere of action has been particularly upon infiltrated tissue, causing its absorption and acting favorably upon spasmodic cough.

Inhalations of vaporized eucalyptus, menthol, pine-needle oil, creosote, naphthalene, iodine, etc., in benzoinol, give us to a certain extent the benefits of climatic change by creating medicated air for respiratory purposes.

* By C. Gurnee Fellows, M.D., Chicago, Illinois State Homeopathic Medical Society, 1895 (as reported in Medical Arena).

Tiny Oxen.

One of the greatest curiosities among the domesticated animals of Ceylon is a breed of cattle known to the zoologists as the "sacred running oxen." They are the dwarfs of the whole ox family, the largest specimen of the species never exceeding thirty inches in height. One sent to the Marquis of Canterbury in the year 1891, which is still living, and is believed to be somewhere near ten years of age, is only twenty-two inches high, and weighs but one hundred and nine and a half pounds. In Ceylon they are used for quick trips across country with express matter and other light loads, and it is said that four of them can pull a driver of a two-wheeled cart and a two hundred pound load of miscellaneous matter sixty to seventy miles a day. They keep up a constant swinging trot or run, and have been known to travel one hundred miles in a day and night without either food or water. No one knows anything concerning the origin of this peculiar breed of miniature cattle. They have been known on the island of Ceylon and in other Buddhistic countries for more than a thousand years.—Tit-Bits.

A MEANS for preventing the noise made by trains in passing over iron bridges has been devised by a German engineer named Boedecker. He puts a decking of 1¼ inch planks between the cross girders, resting on 3 inch timbers laid on the bottom flanges. On the planks a double layer of felt is laid, which is fixed to the vertical web of the cross girder. At the connections with the girder a timber cover joint is placed on felt, and two hooked bolts connect the whole firmly to the bottom flange. Four inches of slag gravel cover the decking, which is inclined toward the center of the bridge for drainage purposes. A layer of felt is laid between the planks and the timbers they rest upon and the ironwork in contact with decking and ballast is asphalted. The decking weighs 600 pounds per yard for a bridge 11 feet wide and costs 23 cents a square foot. It is watertight, and has proved very satisfactory in preventing noise.

Vivisection in Switzerland.

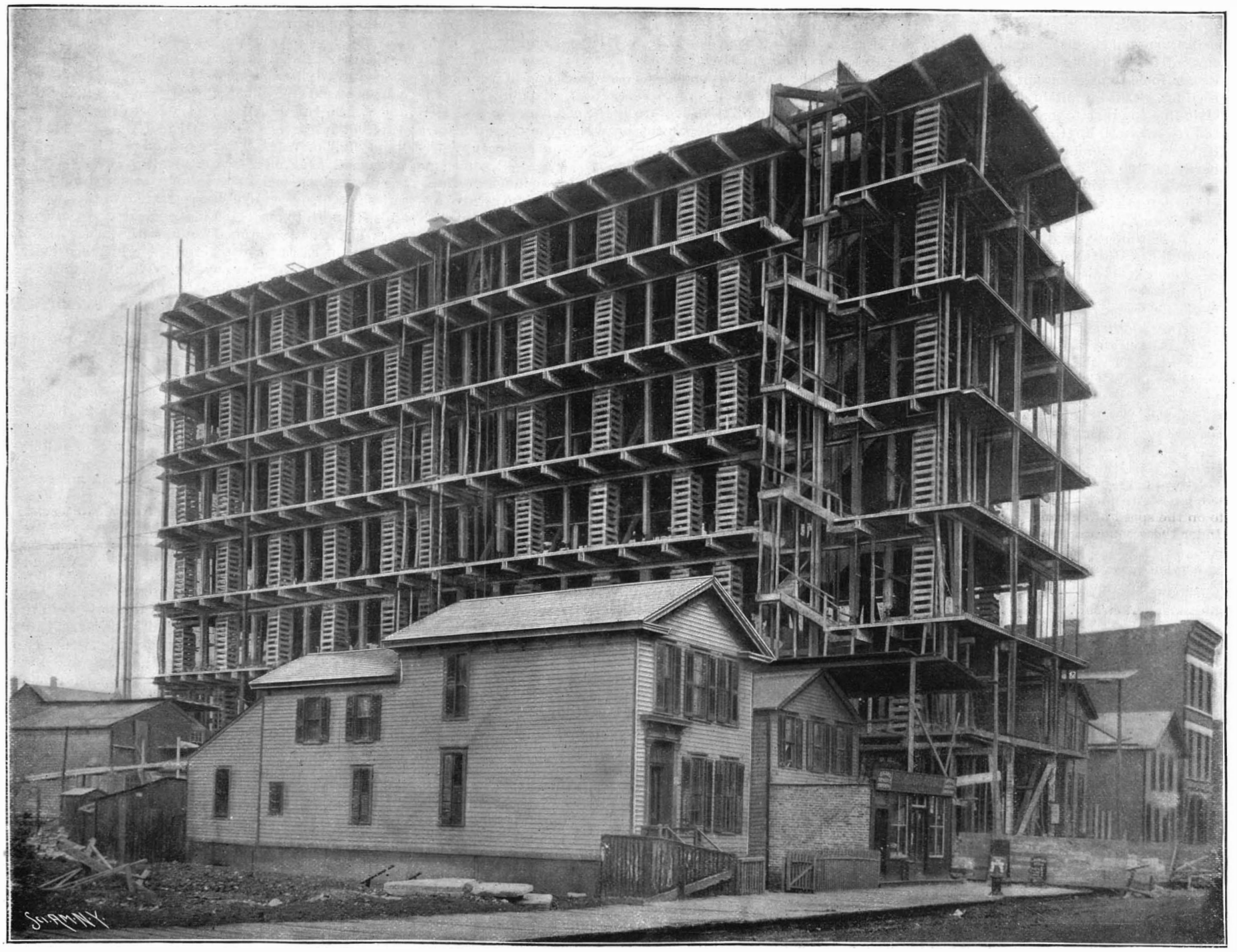
Recently the people of the Swiss canton of Schwyz voted by referendum on the question whether vivisection should be permitted in the canton or not. A motion to prohibit vivisection entirely was rejected by 39,476 votes against 17,297, and a proposal of the local Society for the Prevention of Cruelty to Animals to allow the practice of vivisection for bona fide scientific purposes was adopted by 35,191 against 19,554 votes.

REBUILDING DEFECTIVE WALLS OF A CHICAGO BUILDING.

The De Tamble building, just west of Des Plaines Street, on Jackson Street, Chicago, was built by Martin de Tamble, and completed about October 1, at a cost of about $100,000.

It was already occupied on several of the floors, when one of the tenants—a tailor—thought the walls were not plumb. He brought the matter to the attention of the building department, but no attention was at first paid to him. He persisted, however, with the result that the west wall was found to be 14½ inches out of plumb, and the building was condemned as unsafe and ordered vacated and taken down.

Iver C Zarbell was the architect of construction, and the work of taking down the walls and rebuilding was given to Architect C. H. McAfee. The floors and roof were all supported on cob piles and timbers, as shown in the photograph, and the walls taken entirely down and rebuilt from the foundation. The cause of the settling of the walls was probably the laying of the foundation in dry concrete in frosty weather. It will cost upward of $30,000 to re-erect the building.



NECESSARY REBUILDING OF DEFECTIVE WALLS OF A LARGE STRUCTURE IN CHICAGO.

Was It Luck? An Incident of Old Time Railroading.

S. J. KIDDER, IN LOCOMOTIVE ENGINEERING.

In the summer of 1873 I was running a "Manchester" on one of our great Western trunk lines, pulling what was then known as the "night express," and it was while on the road with this train that I met with perhaps the most peculiar chain of entirely unusual incidents during my long experience running an engine, and in the absence of any one of them a disastrous head-end collision would have occurred.

We were west bound with No. 1, and should have met No. 12 freight and No. 2 at A——. We reached there on time, and headed into a siding, permitting No. 2 to pass. Following the departure of this train, we backed out and pulled up to the station, making our regular stop. The signal was displayed denoting telegraph orders, which, when delivered to the engine, found us thirteen minutes late. While standing at the station, I observed that the relief valve in main reservoir was not operating properly—it was in the days of "straight air"—and the 70 pounds we were supposed to carry had increased to about 90. This higher pressure would give no more than a safe brake force, so far as wheel sliding was concerned; for at that time the low braking force employed was so much superior to hand brakes that maximum efficacy was not a ruling consideration.

From A—— to T—— was a distance of nine miles, the first three miles being down a grade of 70 feet to the mile, the remaining six miles being level, with numerous curves among the bluffs. A half mile from the foot of the grade was a water tank, where, with seven cars, it was our invariable practice to stop for water; but on the night in question, while standing at A——, the fireman reported sufficient water to make M——, fifteen miles away. It should here be remarked that this trip was the only one we ever made with seven cars without taking water at this tank.

One and a half miles east of T—— was a lane crossing seldom used by vehicles, and it was not a practice to whistle at this point, particularly at night.

In approaching T——, the track began curving at the whistling post a half mile east of the station, continuing through and past the station grounds. T—— was simply a passing point having a siding some sixty rods in length and a depot located about midway between the switches. In approaching from the east, the switch and depot were obscured from view by a bluff just east of the switch. On the opposite side of track, parallel to it and about twenty rods away, woods skirted the right of way. The only resident of the "town" was the station agent, who occupied a portion of the depot.

Upon leaving A—— we attained a high rate of speed, in descending the grade, which was kept up across the "bottom."

As we approached the lane, for some reason which I cannot explain, I sounded the whistle and shortly after the station signal at the whistling post. About this time I noticed the reflection of a light on the woods, and my first impression was that No. 12 had left its head light uncovered, denoting that the main line was not clear; next the thought occurred that Den. F. was conductor of the freight, and, contrary to the general practice, he always sent a flagman out at stations, as well as elsewhere.

These thoughts passed my mind in an instant, and I applied the brakes. This had partially reduced the speed when I saw a headlight rounding the bluff. "Over she went" on two pipes of sand, and the occupants of the cab located themselves on the steps preparatory to alighting among the stumps along the way.

Seeing the prospects were fair for stopping, we remained on the engine, finally stopping on a trestle 20 feet in height, and the two engines so close together that in going from the one to the other—the bridge was too narrow to pass along their side—I stepped from one pilot to the other.

The station agent had company that night and was sitting in the telegraph office with his guest, a lantern furnishing the light. He heard No. 12 whistle for the station, followed shortly after by our whistle for the lane crossing, and, noticing by the sound of the former, coming through the dense wood, that they were not going to take the siding, he ran out with his lantern and flagged them.

Now to recapitulate. Had not the relief valve stuck, giving us an excessive pressure of air, 20 pounds more than we usually carried; had we stopped for water at the tank; had I neglected to whistle for the lane; had I not known of the flagging habit of Conductor F., or had the station agent been in bed, where that hour usually found him, those trains would inevitably have come together with dire results, from lap orders.

Is it any wonder that in retrospecting on old time railroading, in thinking of the circumstances as above related, I oftentimes wonder, "Was it luck?"

A Remedy for Black Eye.

There is nothing to compare with the tincture or strong infusion of capsicum annuum mixed with an equal bulk of mucilage or gum arabic, and with the addition of a few drops of glycerine. This should be painted all over the bruised surface with a camel's hair pencil and allowed to dry on, a second or third coating being applied as soon as the first is dry. If done as soon as the injury is inflicted, says the Medical Progress, this treatment will invariably prevent blackening of the bruised tissue. The same remedy has no equal in rheumatic sore or stiff neck.

A FRENCH MODEL ACETYLENE LAMP.

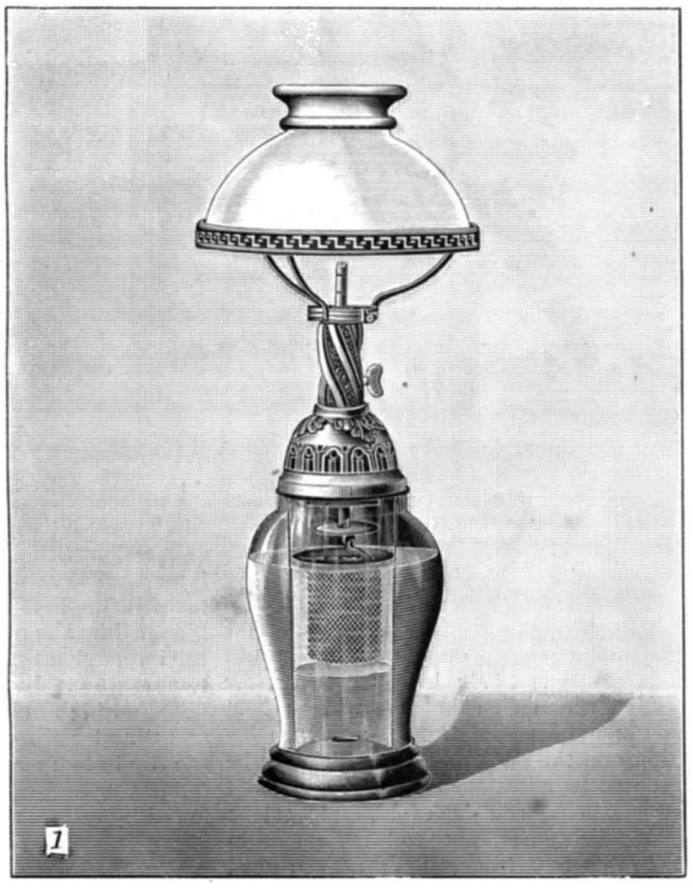
The rapidity with which acetylene has received commercial development is very remarkable. It is hardly a matter of surprise that one of the most artistic and convenient examples of the uses to which this new material as an illuminant can be put is due to the ingenuity and good taste of the French. The lamp shown in the accompanying illustration is from the laboratory of Mr. G. Trouvé, the well known French scientist, and shows the practical form in which the lamp may be constructed to render it available as a portable lamp for domestic uses. Before, however, such a lamp is introduced into general use in the family the fact of its absolute safety and impunity from accident must be assured, and such an end will be reached in time, no doubt, by experiment and by perfecting the apparatus.

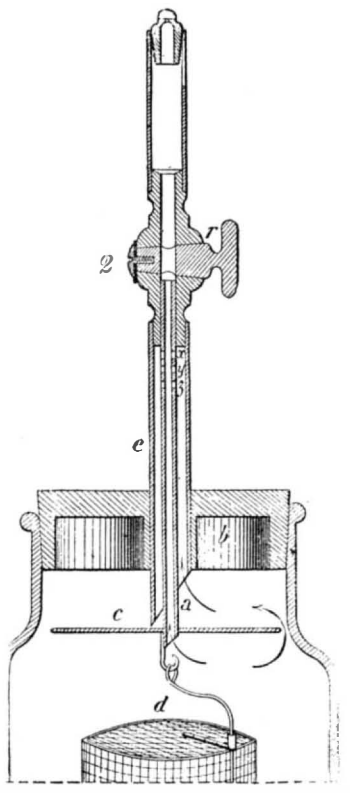
It is interesting to notice the credit given in La Nature to the original simple apparatus, described by T. O'Conor Sloane, in our columns, as being the first acetylene lamp produced, which apparatus was given originally in the pages of the SCIENTIFIC AMERICAN of March 30, 1895. This appeared in the spring of 1895, and La Nature speaks of it as the first acetylene lamp ever made.

G. Trouvé's lamp, of an exceeding simplicity, consists of two glass vessels, one fitting within the other, and of a metal part closing the top, to the center of which top is connected the jet or burner tip.

In the interior vessel, which is practically a bottle with a large neck, is suspended a little metal basket which holds the calcium carbide; the bottle in question has a conical opening in its bottom, the size of which orifice depends on the use to be made of the lamp, so that the movements within this bottle, which acts as a bell jar, shall not be too sudden, depending as they do on the speed of entrance and outflow of the liquid. Under these conditions the flame and its intensity are fixed.

Acetylene, depending on contact with water for its formation, carries off a quantity of vapor of water, which must be instantly condensed so as not to interfere with the proper action of the lamp, whose burner, as in all portable lamps, is very near the generator. Mr. Trouve first tried to obtain this result by means of a condenser with large metallic surface, namely, a spiral ribbon, and later by a still simpler arrangement shown in Fig. 2.





TROUVE'S ACETYLENE LAMP.

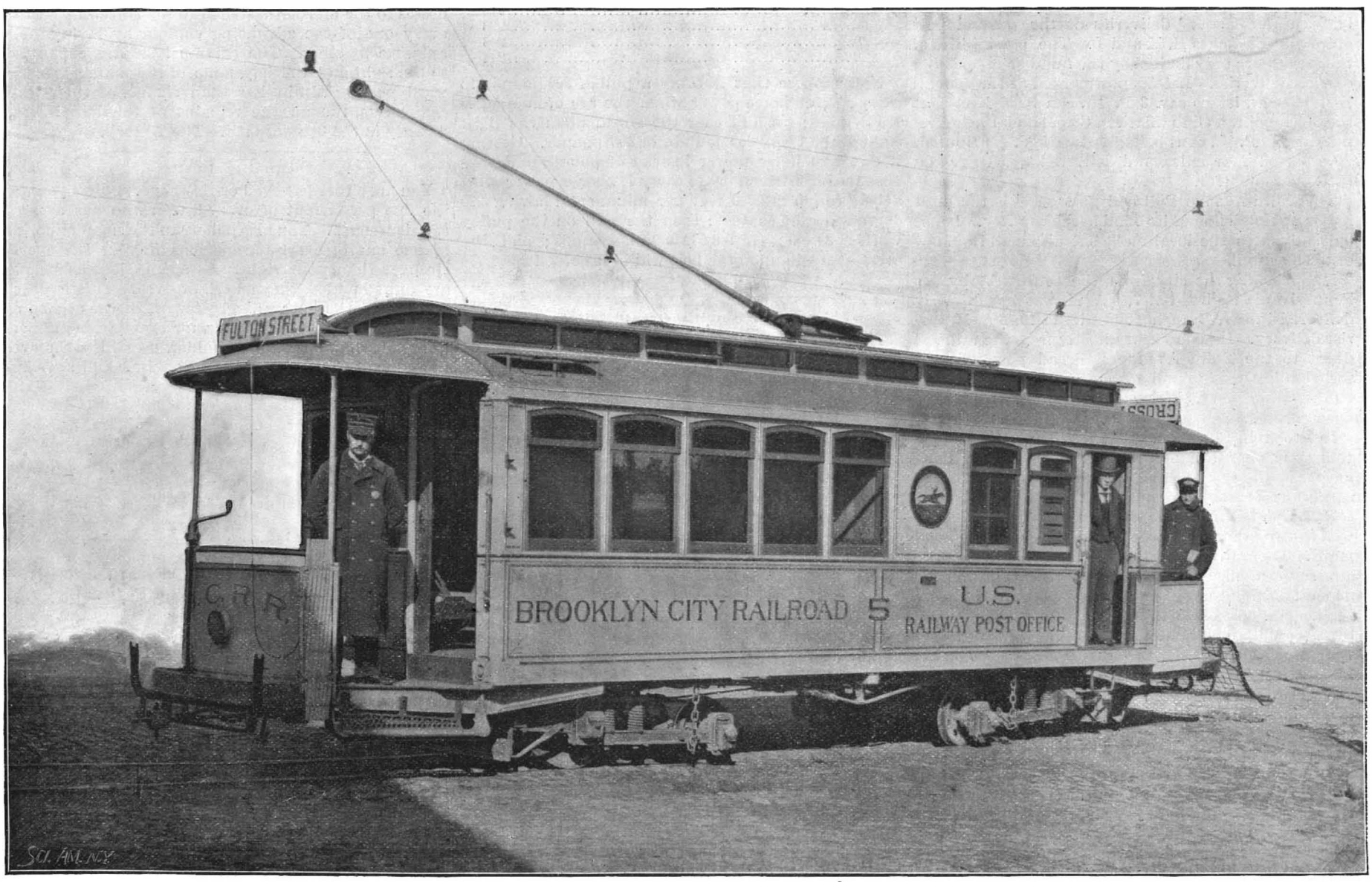
He uses two concentric tubes, a e, cut off obliquely and connecting with the cock, r. At first the gas passes by both tubes to the burner, as is shown by the arrows, but as soon as the vapor condenses in the central tube it seals it and it acts as a siphon. The acetylene continues to go through to the burner by the exterior tube, e, and by the little holes, x, y, z, by which the exterior tube communicates with the interior tube, a. As this siphon action is continuous, the interior tube carries off constantly the condensed vapor of water into the recipient whence it came. Furthermore, a disk, c, of large area, soldered to the tube, a, just above its lower opening, condenses the first vapor carried off by the gas. Furthermore, it enables one to withdraw this tube to get access to the entire system for cleaning and drying it.

It is very important to be able to govern the production of acetylene, because if the basket contains a large quantity of calcium carbide, the production of the gas would become more and more rapid. In spite of the regulation by successive immersions, the vapor of water traversing the calcium carbide from below upward finally moistens the whole mass. To govern adequately the production, Mr. Trouvé has adopted a system of superimposing the lumps of carbide in layers separated from each other by disks of glass. These act as diaphragms to prevent the vapor of water carried off by the gas from traversing the carbide which they support, and the automatic production of the acetylene is uniform from the beginning to the end of the lighting. First the lower layer is reduced to lime, then, as it softens, the second layer, descending, takes its place, and this action is repeated with the successive layers until the carbide is completely exhausted and the disks of glass rest one upon the other on the bottom of the basket.

Acetylene having almost the density of air, 0·92, burns best in a still atmosphere, so that the burner is placed in the center of the metallic disk, which tends to deprive the air of any upward draught, giving the flame proper steadiness. These lamps consume on an average 1,543 grains (about 3¼ ounces) of carbide for 38 candle hours.

STREET POSTAL CAR SYSTEMS OF NEW YORK AND BROOKLYN.

The establishment on February 3 of the street postal car service on Broadway, Brooklyn, again attracts public attention to one of the most important enterprises the United States postal service has undertaken. This is distinctly a novel development of the mail service, and the recent general awakening in this direction is due to the foresight and energy of Mr. Charles Neilson, the Second Assistant Postmaster-General, of Washington. Mr. Neilson's long experience as a manager of rail-



STREET POSTAL CAR SYSTEM—COMPARTED CAR

road systems and his studies as assistant general superintendent of the railway mail service for the United States led him to perceive the immense advantage to the commercial and social interests of the great cities which would come about from having post offices on wheels to keep up a continued and regular exchange and interchange of mails between the main post office and the branch post offices in the large cities of the country.

He has pushed this idea into practice with wonderful rapidity and has accomplished remarkable results in view of the comparatively limited appropriations made by the last Congress for the postal service generally. Mr. Neilson has recommended to the present Congress a specific appropriation of $200,000 for city railway mail service.

On June 30, 1895, there were in operation in the United States 82 street railway mail routes, covering a distance of 573 miles. These lines were performing a daily service aggregating yearly 1,144,201 miles of travel with closed mail pouches carried from one post office to another. The magnitude of this particular class of service is shown by the fact that these lines carried each day 1,856 pouches of mail matter.

The higher development of the work, however, is to have traveling post offices in the cars, in which the postal clerks postmark and assort the mail while it is always in transit, thus avoiding the detention for sorting in the post office where the matter is mailed.

At the close of the last fiscal year there were ten railway post offices of this kind in operation, of which seven were in Boston, one in Brooklyn, one in Philadelphia, and one in St. Louis.

In New York and Brooklyn great strides have been made since July 1, 1895. In New York City General Neilson's views were heartily appreciated and furthered by Postmaster Dayton and his chief of city delivery division, Mr. E. M. Morgan.

On October 1 the Third Avenue Railway post office was established to effect a rapid interchange by mail between the general post office and the great east side section of the city. The Third Avenue Railroad Company took up the subject with enthusiasm, determined to make the experiment a success. The postal cars are the handsomest that could be made.

There are twenty-five postal clerks assigned to the Third Avenue line. The cars run from the general post office every half hour, and make an equal number of trips southward. On the way they exchange mails with Branch D (Ninth Street), Branch F (Twenty-eighth Street), Branch H (Forty-fourth Street), Branch Y (Sixty-eighth Street), Branch K (Eighty-sixth Street), Branch L (East One Hundred and Twenty-fifth Street), Branch J (West One Hundred and Twenty-fifth Street), and Branch M (Amsterdam Avenue and One Hundred and Fifty-seventh Street). Mails are worked en route at present to connect directly with the carriers' deliveries at the general post office and Branches H, K and L. The possibilities of the service are only limited by the number of existing carrier deliveries. Letters postmarked at the general post office at, let us say, 3 P. M., can be delivered at the Metropolitan Club (Sixtieth Street and Fifth Avenue) at 4:15 P. M., thus being postmarked, distributed, transported four miles, and delivered by carrier in a little over one hour.

The Third Avenue Railroad post office is the most important mail line of its kind in the country. It not only advances the local mail, but also mail from out of town as well.

Mail reaching the city from the southwest by the Pennsylvania Railroad at 7:40 A. M. was not formerly delivered at, say, Branch H until the 10:45 A. M. carrier delivery. It is now sent directly from the railroad depot to the Third Avenue Railroad post office, is sorted going uptown and goes out to the public on the 9:15 A. M. delivery. Many other similar gains have been effected.

In Brooklyn Postmaster Sullivan has been very enthusiastic over the new service, and Assistant Postmaster McCooey and Superintendent Lyon have been earnest assistants in promoting the new scheme.

Brooklyn has now four street railway post offices as well as two other street car mail lines carrying closed mails. The railway post offices run: First, from the general post office to Coney Island; second, from the general post office to Long Island City; third, from the general post office to East New York via Fulton Street; and, fourth, from the Broadway Ferry to East New York via Broadway. All branches of the Brooklyn post office are connected by these lines, and the service is hourly.

The cars in use in the New York service are devoted entirely to post office business. The cars in use in Brooklyn are known as comparted cars; a compartment at one end being used for the mail service while passengers occupy about two-thirds of the car, as shown in the engraving. The mail cars in both New York and Brooklyn are painted white.

The clerks employed in these cars are appointed in the railway mail service and Superintendent V. J. Bradley—to whom we are indebted for the facts here given—has charge of their assignment and their work.

There is now a direct interchange of mails between the Third Avenue Railway post office in New York City and the Brooklyn Railway post offices via the Brooklyn Bridge without any of the old detention caused by the mails going through the main post offices in both cities.

Any one can see from this brief recital what a revolution has been accomplished in the methods of transmission and interchange and the possibilities of further and minute development which will not only expand and multiply mail communication in the metropolitan district, but also unify and interconnect the segments of Greater New York.

Belt Strain.

To find out whether the force carried by a belt is more than should be properly put upon it, or upon its fastening, we must know how much the arc of contact is, and what the tension on both the tight and the slack folds. The greatest tension upon it is that in the tight fold or side; and this is equal to that on the slack side, plus the pull which the belt gives to the pulley, or which the pulley gives to it. The greater the arc of contact the greater the ratio between the tight and the slack side, and the less the strain will be upon the belt and its fastening, to transmit a given power at a steady speed.

Thus if we have a pull of 10,000 pounds necessary to carry a certain horse power, when the arc of contact of the belt on the pulley is 90 degrees, that means that the ratio between the tension on the tight side and that on the slack side is 1·874; in other words, for every pound upon the slack side there will be 1·874 pounds on the tight side; and if the difference between the tensions on the slack and the tight sides be 1,000 pounds, it will be necessary to have 1,000 ÷ 0·874 = 1,144 pounds strain on the slack fold, and 2,144 on the tight one. (These figures apply to leather belts in good condition upon cast iron pulleys, also in good condition.)

Working from this we get the following table for various arcs of contact from 30 degrees to 300 degrees:

TABLE OF GREATEST STRAIN ON BELTS.

Arc. Degrees.	Ratio Between Strain and Transmitted Pull.
30	5·29
45	3·71
60	2·92
75	2·45
90	2·14
105	1·93
120	1·77
135	1·64
150	1·54
165	1·47
180	1·40
195	1·35
210	1·30
240	1·23
270	1·18
300	1·14

Now suppose that it takes a pull of 300 pounds to carry a given horse power when the arc of contact is 195 degrees; we find that the strain upon the tight side will be 1·35 × 300 pounds, or 405 pounds. Getting it down to horse power instead of pounds pull, suppose that it is necessary to carry 175 horse power with a belt running 2,000 feet per minute and having 210 degrees arc of contact; then the pull on the pulley will be 33,000 × 175 ÷ 2,000 = 2,887 pounds; and the greatest strain upon the belt will be 2,887 × 1·3 = 3,753 pounds.

Commerce with Great Britain.

The following figures of imports to and exports from the United States and dependencies for the fiscal year 1895 are given as follows by Bradstreet's:

	Imports from United States.	Exports to United States.
United Kingdom	$159,083,243	$387,125,458
Gibraltar	7,807	381,875
Bermuda (prior to 1892 included in British West Indies)	405,707	821,534
British Honduras	181,809	402,933
Dominion of Canada, Nova Scotia, New Brunswick, etc	5,851,615	4,041,775
Quebec, Ontario, etc	26,919,413	46,712,706
British Columbia	3,803,299	2,100,208
Newfoundland and Labrador	431,836	1,126,999
West Indies—British	9,777,444	7,764,178
Guiana—British	2,521,704	1,705,631
East Indies—British	21,266,013	2,853,941
Hong Kong	776,476	4,253,040
British Australasia	4,620,828	9,014,268
British Africa	776,114	5,203,378
All other British	1,382,673	637,797

ELECTRIC railroads are proving of great benefit to the farmers in all parts of the country. The trolley lines run out from the large cities and towns to villages far removed from steam railroad communication, and in several districts arrangements are making to run trolley milk trains, vegetable trains and the like, to enable the farmers to get their produce quickly to market. It is even proposed to run trolley coal trains, to supply coal to small towns that now use only wood.

Correspondence.

Local Causes of Rain.

To the Editor of the SCIENTIFIC AMERICAN:

Will the SCIENTIFIC AMERICAN kindly inform me whether rain is always preceded by a rise in the temperature; and if so, how much of a rise or how sudden a change is necessary to produce it? W. F. W.

Brooklyn, N. Y.

[The Weather Bureau, to whom the matter was referred, reports as follows:

In answer to the query submitted by Mr. W. F. W., Brooklyn, N. Y., I have the honor to inform you as follows: Meteorologists are now adopting the opinion that dynamic cooling, if not the sole cause of rain, is, at all events, the only cause of importance. Whatever, therefore, will bring about an ascensional movement of moist air may be said to produce rainfall. In the tropics, where the insolation is much more constant than in these latitudes, clouds are formed regularly in the morning and rise to great heights in the afternoon, generally causing rain. By nightfall the sky is clear, and on the succeeding day the process is repeated. Here there is no rise in temperature other than that due to the altitude of the sun above the horizon. In the middle latitudes much of the rainfall occurs in connection with a cyclonic circulation in which there is an upward as well as a horizontal component. The temperature in advance of cyclonic storms is generally higher than the normal, and to this fact may be due the impression that rain is generally preceded by high temperature. In the summer season a period of great heat and high humidity is generally broken by rain and thunder storms, but it is not correct to infer that the rise in temperature is the cause of the rain that follows, or that a rise in temperature is necessarily followed by rainfall. Very respectfully,

WILLIS L. MOORE, Chief of Bureau.]

Have Ants a Language?

Because incomprehensible to us, there is no reason to believe that animals have no direct means of communicating with one another. Even in the insect world investigation has practically proved the fallacy of this supposition.

Sir James Boyle, the great Irish naturalist, always contended that ants had a language of their own, by which they made known their wants and fears to others of their kind. One day he encountered a colony that were evidently moving to new quarters. All appeared in the very best of spirits, and whenever two met, the naturalist noted that they put their heads together as though chatting very earnestly. To settle the matter in his own mind as to whether they were really talking or not, he killed one of them to observe the effect it would have on the others. The eye witnesses to the murder hastened to the rear and halted every one of the advancing column by laying their antennæ together. The column instantly separated to the right and the left, none of the marchers afterward passing within less than six feet of their dead companion, though the remains of the insect were directly in the beaten path.—The Argosy.

Inequality in Eyes.

You are either left eyed or right eyed, unless you are the one person out of every fifteen who has eyes of equal strength. You also belong to the small minority of one out of every ten persons if your left eye is stronger than your right. As a rule, just as people are right handed, they are right eyed. This is probably due to the generally greater use of the organs of the right side of the body, as, for example, a gunner, using his right arm and shoulder, uses his right eye, thereby strengthening it with exercise. Old sea captains, after long use of the telescope, find their right eye much stronger than the left. This law is confirmed by the experience of aurists. If a person who has ears of equal hearing power has cause to use one ear more than the other for a long period, the ear brought into requisition is found to be much strengthened, and the ear which is not used loses its hearing in a corresponding degree.

Patent Injunction—Government Use.

In the case of Belknap vs. Schild et al., decided recently by the Supreme Court of the United States, it appeared that the defendants were the owners of a patent caisson gate used by Belknap in prosecuting government work without permission of or compensation to the owners, and they sued for an injunction and an accounting. The trial court granted the injunction and a master reported the damages at $40,000. The court held that the invention being used by an officer of the United States for the common defense and general welfare, no injunction could lie against him, and that the only damages proved being those in behalf of the United States, for which he could not be held liable, the judgment of the lower court must be reversed with instructions to dismiss the bill, without prejudice to a suit at law against the officer for damages or against the United States in the Court of Claims.

THE BOA CONSTRICTOR.

The boa constrictor is one of the western representatives of the Boidæ family, inhabiting Honduras, Mexico, Santa Lucia, Guiana, Brazil and Peru. Cuvier decided that there was no boa in the old world. It was the object of snake worship among the Aztecs, and the skin of a boa used in this cult is now preserved in the British Museum. The boas are constricting serpents, killing their prey by coiling around it and compressing it until life is extinct. Their jaws are armed with strong, sharp teeth curved backward, the upper set interlocking into the lower. This gives their bite great holding power, and anything once seized they are almost unable to release. They are without venom. The jaws are peculiar in their articulation. Their members are merely connected by ligaments, so that they can be greatly distended, and besides this, they can actuate one-half of the jaws at a time, so as to hold their prey while swallowing it.

Their system receives nourishment in a peculiar manner. After killing an animal they swallow it whole, the animal swallowed often being enormous compared to the boa. The jaws open and distend and work along over the body being swallowed, it sometimes seeming as if the skin of the boa must burst under the strain. After the swallowing is effected, which may take several hours, the snake becomes torpid and spends sometimes as much as three weeks in this condition, gradually and almost completely absorbing the animal swallowed. It has been a subject of dispute whether breathing is suspended during the swallowing operation. The boa constrictor rarely exceeds twenty feet in length, and is said not to be feared by the Indians of its habitat, who kill it with a stick. One very curious feature in its anatomy is the presence of two small hook-like claws on its under surface, which represent the termination of rudimentary limbs.

Our illustration shows a boa incubating, with its eggs distributed among its own plications. The eggs contain each a living reptile, the boa being ovoviviparous. The eggs are about as large as those of the hen. Some twenty years ago a boa in the Central Park menagerie in this city laid twenty-one eggs and each third egg was sterile. One snake came out of the egg at once, but soon died. The others never left the egg.

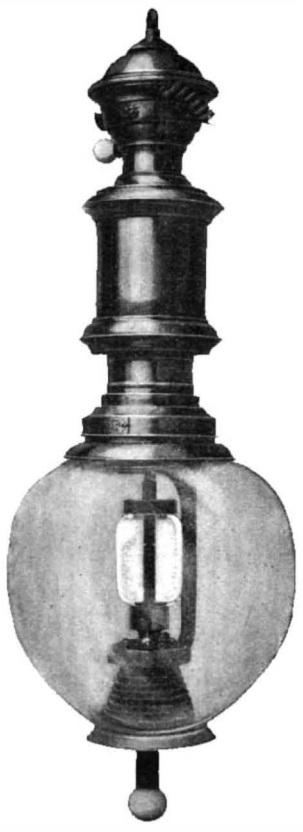
Lovers of Rudyard Kipling will remember how picturesquely he has written of the constricting serpent, python, a near relative of the boa, in his Jungle Books, and how graphically he has described his method of striking a blow by projecting himself head on directly at the object to be struck.

Cold Air for Consumptives.

There are now six sanitariums in Germany at which consumptives are treated by constant exposure to air at a low temperature. Currents of cold air are allowed to pass through the bedroom at night, and during the day as much of the time is spent in the open air as possible. The pure cold air quiets cough, lessens temperature, arrests night sweats, improves appetite, and modifies or arrests the course of the disease.

THE MANHATTAN INCANDESCENT ARC LAMP.

The arc lamp illustrated herewith has several points of novelty, chief among which is the inclosing of the adjacent ends of the carbons in an approximately air-tight glass globe, which confines the gases driven off by the carbons as they are slowly consumed, thus surrounding the arc with an atmosphere practically without oxygen. By excluding oxygen in this manner the life of the carbons is greatly prolonged, so that one pair of half-inch carbons will burn for more than 150 hours, or about twenty times as long as the carbons in an ordinary arc lamp.



THE MANHATTAN ARC LAMP.

The construction of the lamp is such as to permit of using it singly between the mains of any direct incandescent circuit with little waste. The arc is of such length as to give a light more nearly of the quality of sunlight than any other artificial light, while the double globe surrounding the carbons causes a diffusion of the light, which obviates the painfully sharp shadows peculiar to the ordinary arc light. The mechanism of the lamp is arranged symmetrically around the axial line of the carbons, thereby insuring great compactness and simplicity, at the same time securing the uniform feeding of the carbons and producing a light without flicker or irregularity.

The slow consumption of the carbons necessitates correspondingly slow feeding, and results in a great saving of carbons as well as of time required in trimming.

In design the lamp is plain and simple, but it is capable of artistic treatment, and can be made truly ornamental.

Andree's Polar Expedition.

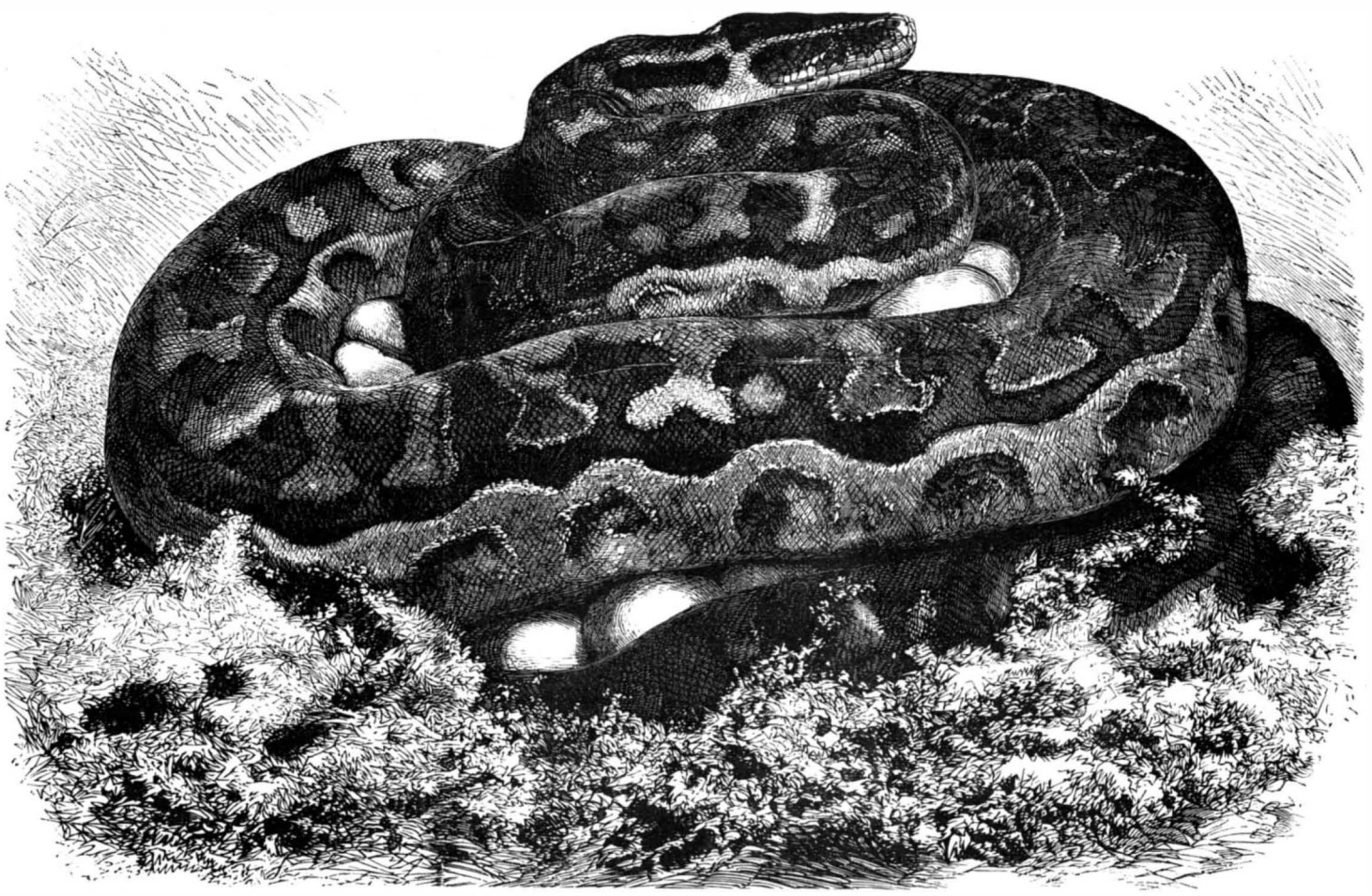
The Ministry of Foreign Affairs at Stockholm has sent notice to the governments of Russia, Denmark, Great Britain, and the United States of Herr Andrée's projected balloon voyage to the North Pole, and the co-operation of these nations is asked. The authorities in the countries immediately surrounding the polar circle will be asked to distribute thousands of leaflets containing illustrations of the balloon and asking for information as to the time at which it is seen and the direction of the wind at the moment.

The Wood in Violins.

The front of a violin is usually made of deal, the back of maple. Now, a piece of wood can be set in vibration just like a string in tension, and a certain musical note will be the result, the pitch depending upon the length, thickness, and density of the wood. The curious fact has been established by experiment that in all the best Stradivarius violins the "note" produced by the front of the instrument is the same; and again, that in no case is the note of the front the same as the note of the back. It is known that there are acoustic reasons for this, and these reasons determine the kind and quality of the wood. The front of the instrument must be light, soft and porous, and deal answers best to these demands. When the wood is dry, the microscope will reveal a multitude of little hollow cells, once filled with sap. The more of these cells there are, the more quickly will the wood vibrate to the sound, and here fine skill in selecting the wood comes in. The maker might cut up a dozen pieces of deal, and perhaps only one piece would be absolutely perfect for its purpose. Similarly with the maple, of which the back of the instrument is made. This is a harder wood, containing less sap, and consequently fewer cells when dry. It is used because it vibrates more slowly than deal, and the effect on the violin is to detain the waves of sound radiating from the deal and to mix them with slower vibrations of the back in the hollow of the instrument. The ribs and sides of the violin are of maple, and these serve to connect the quickly vibrating front with the slowly vibrating back and hold them until both throb together with full pulsation and body of sound.—American Woodworker.

A Great Light at Barnegat Lighthouse.

A light of exceeding great power, probably exceeding in brilliancy any to be found on any seacoast in the world, is soon to be placed in the lighthouse at Barnegat on the New Jersey shore. It is one of the great German search lights exhibited by Schuckert & Company, of Nuremberg, at the Columbian Exposition, and illustrated in the SCIENTIFIC AMERICAN of September 2, 1893. It was purchased by the government to be placed on Fire Island, but Barnegat has been chosen instead as its location. The present light at Barnegat is 165 feet above the level of the sea, and it is said that it can be seen under ordinary circumstances at a distance of nineteen nautical miles. Important additions have been made to Barnegat lighthouse to prepare it for the new light, which is of such brilliancy that it will penetrate haze and fogs that have often made the present light invisible. The lamp used in the projector at Chicago required a current of 150 amperes at 50 volts, and consumed about 10 electrical horse power. By its light a person standing eight miles away could read a newspaper. The light was placed, at the exposition, at a height of 240 feet from the ground, and one standing at the side of a projector could with a good field glass distinguish vessels twenty miles away upon the lake. The new light should be a great convenience to navigators approaching the Jersey shore in a fog.



BOA CONSTRICTOR, WITH EGGS.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM CONDENSER AND AERATOR.—Edward Rowe, Indiana, Pa. This is an apparatus designed to quickly condense the steam from an engine and relieve it of back pressure, prevent water from the engine running back into the exhaust pipe, and aerate the water of condensation to make it better for use in the boilers. It comprises a shell with air inlets into which extend nozzles from a steam distributor, drawing in air to mingle with the steam in the shell, the nozzles being connected with a compressed air supply.

BLAST FURNACE RELIEF DEVICE.—James Andrews, Allegheny, Pa. This improvement is designed to afford instant relief in case of a sudden explosion of gases in the top of the stack. The bell is made with doors hinged at their lower ends in its sides, the doors normally forming part of the sides of the bell and being adapted to swing open on pressure from within. The doors are sufficiently heavy to withstand the ordinary pressure of from seven to twelve pounds within the furnace.

Railway Appliances.

CAR REPLACER.—Robert B. Hawkins, Clarendon, Texas. This replacer may be made principally of old rails, and is very simple and of great strength, providing efficient means for guiding the wheels of a derailed car to the track, even from a considerable distance. In arranging the device an ordinary center-bearing rail is so disposed that its base and head are vertical and its web horizontal, a clip with a hooked end projecting laterally from the replacer rail to engage the head of the track rail, while the opposite end of the clip is formed to bear against a tie.

CAR FENDER ATTACHMENT.—Robert Muir, Brooklyn, N. Y. Attached to the fender frame, according to this improvement, are a number of spaced and bowed springs, the free or central portion of the springs being all located in the same plane, so that they will come in contact with each other when striking an obstruction. Should the springs strike a prostrate body or movable obstruction, they are designed to gently push the body or obstruction from the track, in a manner not likely to injure a person.

RAIL JOINT.—William D. Jones, Homestead, Pa. For detachably securing together the ends of railway track rails, this inventor provides a novel and simple joint, easy to apply, effective in service, and readily removable for making repairs. The fish plates and rails are transversely apertured, the plates having sloped and grooved faces, while clamps passed through the aligned apertures in the rails and plates have diverging limbs adapted for engagement by spring latch pieces on the fish plates.

CAR BRAKE.—Ferdinand Gabler, Topeka, Kansas. This is an improvement on a former patented invention of the same inventor, toggle arms at each side of the car being connected to adjacent brake shoes and jointed to each other in the middle, there being a spiral spring between and connected to the brake shoes of each pair, two transverse stems being also connected to the middle joints of the toggles, while an equalizing device is connected to the inner ends of the stems and to the brake-applying mechanism.

Electrical.

BATTERY.—Walter S. Doe, Brooklyn, N. Y. In a suitable jar is a porous cup with bottle-shaped top portion, the cup being sealed in the jar and containing the carbon element and a depolarizing fluid, the zinc element being made as a ring surrounding the porous cup. A rod connected with the carbon extends through and is sealed in a top opening, a like opening forming a passage for the conducting rod of the zinc element. The arrangement obviates the escape of dangerous gas, and facilitates utilizing the power of the battery to its fullest extent.

ELECTRIC TYPEWRITER.—John L. Garber, Sidney, Ohio. This invention provides electrically operated means for moving the typewriter carriage, and for moving the platen or roller of the machine. Arranged adjacent to the typewriter are solenoid-magnets with spring-pressed plunger armatures connected by a cross piece in which slides vertically a spring-pressed arm having a tooth to engage a notched bar secured to the carriage, a magnet-operated lever effecting the vertical movement of the toothed arm, and a circuit closer being arranged in the circuits of the lever magnets and the solenoid magnets. The improvement may be used with all kinds of typewriters having a sliding carriage.

Mechanical.

LIFTING JACK.—Malcolm Anderson, New York City. This is a jack of simple and strong construction arranged to readily transfer the load from the screw spindle head to an auxiliary support and to shift the load laterally with the support. An eccentric is mounted to revolve and be raised and lowered with the load-lifting spindle, a support held on the eccentric being adapted to be shifted laterally thereby, while a nut screwing on the spindle raises and lowers the eccentric.

COMBING MACHINE.—Anthony Guneman, Hoboken, N. J., and George Schacht, Jersey City, N. J. This is a compactly foldable, portable machine of simple and inexpensive construction, for combing, without breakage or injury, hair, moss, fiber, wool, etc., ample air being supplied during the work of combing and the escape of dust being facilitated. Provision is also made for easily and thoroughly cleaning the combing teeth.

MACHINE FOR TAPPING MAINS.—John Hearne, New York City, and Elmer E. Cisco, Brooklyn, N. Y. This is a portable machine adapted to be easily fastened upon a pipe, and of such construction that a hole may be drilled, reamed and tapped in the pipe and a cock introduced without loss of fluid and without danger of asphyxiation. The tool may also be removed from the pipe and another tool introduced without the escape of fluid.

Miscellaneous.

TYPEWRITER RIBBON HOLDER.—Edwin L. Foster, Independence, Kansas. For readily clamping the typewriter ribbon to the spool, facilitating its quick attachment and easy removal, this invention provides a clamp having arms riveted or pinned near one end to the spool heads and flared outwardly, a cross bar uniting with the arms at a point between their ends, the cross bar being curved transversely, corresponding to the curvature of the spool body.

LETTER FILE, ETC.—Richard Bennett, Neihart, Montana. This is a simple, inexpensive device, neat in appearance and well adapted to hold blanks, bills, letters, etc. Covers secured to a back are provided with eyelets at opposite ends, index sheets being held between the covers, and elastic cords extending through the eyelets across the space between the covers to engage the index sheets, hooks on the covers engaging loops at the ends of the cords.

CALIPERING INSTRUMENT.—George W. Mings, Holy Cross, Col. This instrument has two pivotally connected members provided with sets of adjustable pins for measuring small and large articles, one of the members being provided with a frame with forked arms in which segmental dials are adapted to be inserted and clamped, a pointer with a reading wire or hair extending on the dials, while a magnifying glass is held on the pointer over the wire or hair. The implement is adapted to automatically indicate the size of the article gaged in standard and other measurements.

BANK SAFETY VAULT.—Thomas Barnes, Rawlins, Wyoming. This invention provides for the erection of a burglar and fire proof vault on a skeleton frame elevated from the ground or floor of a building to expose the lower side of the vault, a gallery sustained by the supports completely encompassing the vault, while mirrors are arranged to reflect all sides of the vault in a manner to be visible from the street.

LOCK.—Andrew Alfors, Hanna, Wyoming. In this lock the body section has hinged connection with the face plate, which is provided with a keeper adapted for engagement by a rotating key-actuated bolt carried by the body section, a retarding device offering resistanee to the bolt. The lock is especially adapted for trunks, boxes, etc., and is simply and inexpensively made.

CONTROLLING HATCHWAY DOORS.—Frederick F. Jackson, Chicago, Ill. For automatically controlling the closing of hatchway and other doors, this inventor provides a system of wiring to be used in connection with thermostats, the wiring being connected with a lock mechanism by which a door or doors will be closed by the action of heat on thermostats. A retarding mechanism is also provided by which the doors may be prevented from closing for a certain time, other operating mechanism being set going, and an alarm sounded if desired.

FIRE ESCAPE.—John Evans, Denver, Col. This is a portable device, adapted to be readily carried in a trunk for use by travelers and others, and comprises a light and strong frame in which are journaled rollers by means of which a regulated pressure may be placed upon a hanging rope, affording means to let a person down from a building, a strap or other girdle encircling the person of the user. By graduating the draught strain one can lower himself to the ground as slowly or as speedily as desired.

VEHICLE AXLE.—Henry M. Powell, Florence, Ga. This invention comprises a sand box adapted to fit over the end of the hub and provided with portions for connection with the body of the axle and for detachable connection with the spindle. The improvement affords a novel construction for taking up lost motion and wear of the hub upon the spindle, and when a wheel or spindle, or both, become badly worn, the spindle may be removed and replaced by a larger spindle.

PUMP OPERATING MECHANISM.—William A. Anderson, Alpha, Mo. For operating pumps by a windmill rod or by hand this invention provides a simple, light and inexpensive mechanism carried by an open frame adapted for easy attachment to the upper end of a pump stock at the platform of the well. The mechanism is designed to have a minimum of friction and give the greatest amount of working efficiency with the least outlay of power.

WASHING MACHINE.—Loren B. Walters and Kinsey Cadwalader, Georgetown, Texas. Among other improvements, this machine presents a novel construction of casing and gear framing, together with improvements in the clothes receptacle and the devices for sscuring a circulation of water and steam through the clothes. The clothing may be placed in the machine with cold water and the latter gradually brought up to the boiling point.

ASH SIFTER.—Agnes E. Bennett, Toronto, Canada. This sifter comprises a cylindrical screen journaled in a suitable casing and adapted to be turned in sifting by a crank, the cinders being retained within the casing during the operation and the dust being received in a drawer at the bottom, from which it may be conveniently removed. After the sifting the cinders are discharged through a chute to a receptacle.

CIGAR BOX.—William F. Fuchs, Galena, Ill. This box has a false bottom adapted to be raised and lowered and held in adjusted position, ribbons or tapes being employed to thus manipulate the false bottom. Springs are also used on the false bottom to prevent the cigars becoming loosened during transportation, and the lifting tapes may be employed to hold bundles of cigars in position. With this improvement cigars may be packed on the bottom from the top of the box and the bottom adjusted downward as the successive rows are placed in position.

WINDOW CURTAIN AND PILLOW SHAM SUPPORTER.—Edward W. Farnham, Chicago, Ill. This improvement is designed to obviate the use of clumsy poles and brackets, substituting therefor a practically invisible support, which may be easily put up and removed and packed in a small space. With this improvement, also, rings and pins are not required to support the curtains or shams, which are held by means of clutch brackets and an adjustable wire line arranged in a novel manner.

RAISING AND DRAWING OFF LIQUIDS.—Alphonse Bonnoront, Paris, France. The apparatus devised by this inventor employs in its operation the water pressure from a tank or other suitable source, and comprises neither a flap valve nor piston. A vessel communicating with the liquid to be raised is cut off from the atmosphere, and water under pressure is introduced to compress the air in the vessel and also in a closed cask communicating with the liquid reservoir, thereby forcing the liquid through its discharge tube. The improvement may be employed in the place of beerpumps, etc.

FOLDING GAMBREL.—Peter N. Swanson, Galva, Ill. This is a novel folding device for the suspension of a carcass of dressed beef, etc., in such manner as to facilitate work thereon in preparing the dressed meat for consumption. It comprises a hanger bar to be suspended from a support, there being on the bar two outwardly movable arms supported by adjustable flexible connections and having adjustable hooks.

BUTTON.—Daniel B. Seward, Easthampton, Mass. This invention provides a combination button with a solid center of vegetable ivory, bone, etc., affording a proper support for, and engagement of, the cloth covering, together with a clamping ring or shell therefor, enabling the button to be cheaply produced and the cloth covering neatly and securely applied. The button, instead of being sewed on by the ordinary tufts, is secured by means of apertures extending through its solid center.

DUST PAN AND VENTILATOR.—Francis M. Rector, Eddyville, Iowa. This device comprises a casing adapted to be set in the floor or wall of a building, and having a grated top, a box in the casing being provided with a slatted bottom, which may be opened and closed. The device may be employed to facilitate the ventilation of a room or as a dust pan to receive its sweepings.

Designs.

ERASER.—Oliver C. and Charles W. Hackett, Akron, Ohio. This design is for an instrument which is nearly oval in cross section at about its center and tapers toward both ends, presenting an elongated flattened ovate form, the head having one side roughened and the other smooth.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

NEW BOOKS AND PUBLICATIONS.

TRIBUNE ALMANAC AND POLITICAL REGISTER FOR 1896. Henry E. Rhoades, editor. New York: The Tribune Association. 1896. Pp. 305. 16mo. Price 25 cents.

The Tribune Almanac was founded in 1838 as "The Whig Almanac." It is one of the oldest and now ranks among the highest of all American annuals for its accuracy and completeness.

THE DAILY NEWS ALMANAC AND POLITICAL REGISTER FOR 1896. Compiled by George E. Plumbe. Chicago: Chicago Daily News Company. 1896. Pp. 452. 16mo. Price 25 cents.

This almanac is very much like the preceding, and it is even more largely devoted to political affairs.

REPORT OF THE COMMISSIONER OF EDUCATION FOR THE YEAR 1892–1893. Vol. I. Containing parts 1 and 2. Washington, D. C.: Government Printing Office. 1895. Pp. 1224. 8vo.

This work contains a vast amount of useful information. In addition to the statistical summaries there are chapters on public education in Belgium, France, England, India, Canada, Germany, Uruguay, as well as chapters on the recent developments in the teaching of geography in Central Europe.

The bound volume for the year 1895 of Garden and Forest, a New York Journal of Horticulture, Landscape and Forestry, affords a large amount of exceptionally high class reading on the subjects to which this publication is devoted, and timely topics germane thereto. To the scientific gardener, and especially to all interested in the preservation of trees and the general promotion of their growth by wise and practical means, this weekly is an invaluable assistant, and the 500 large pages comprised in the volume present much matter well worth preservation and reperusal.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6729) A. V. H. says: Kindly inform me the relative value of the following materials: cinders, coal ashes, coal, sawdust, mineral wool, as a nonconductor when used as filling or insulation in ice house walls which are eight inches thick. A. The following table gives the results of a series of experiments by Mr. C. E. Emery, for the New York Steam Company:

Material.	Non-conductivity. Per cent.
Hair felt	100
Mineral wool No. 2	83·2
Mineral wool No. 2 and tar	71
Sawdust	68
Mineral wool No. 1	67·6
Charcoal	63·2
Pinewood, across grain	55·3
Loam	55
Gasworks lime, slaked	48
Asbestos	36·3
Coal ashes	34·5
Fuel coke	27·7
Air space, 2 inches deep	13·6

(6730) C. W. M. asks: 1. What should be the dimensions and the size of the wires for a transformer to use a current of twenty-five amperes at 120 volts and furnish a current at one volt, and how many amperes would such a transformer furnish? A. The size of the transformer depends on the frequency of the alternations. For the primary you must use No. 9 wire. The primary must have 120 turns for one of the secondary. The secondary will give nearly 25×120=3000 amperes on short circuit. 2. Is there any difference between a gas engine and a petroleum engine other than the addition of the vaporizer? A. Little or none; proportions may slightly vary. 3. Could a gas engine be used as a petroleum engine by adding the vaporizer? A. Yes. 4. How is this vaporizer made? Have you ever described its construction and operation in the SCIENTIFIC AMERICAN or in the SUPPLEMENT? A. For details of gas and oil engines we refer you to our SUPPLEMENT, Nos. 535, 618, 715, 716, 963, 993, and 1024, price 10 cents each. 5. According to the best practice, what is the characteristic difference between the construction of a motor and a dynamo? A. There need be none. A cast iron field is used in dynamos to make them self-charging. For motors a soft iron field is better.

(6731) E. H. S. asks: Suppose Hiero's crown was an alloy of silver and gold, and weighed 22 ounces in air and 20½ ounces in H_2O. What was the proportion of each metal? A. Apply the following formula: Let

a = weight of alloy in air.
b = weight of alloy in water.
c = specific gravity of gold.
d = specific gravity of the other metal.
x = weight of gold in the alloy.

Then a—x = weight of other metal in the alloy.

$\frac{x}{c}$ = weight of water displaced by the gold.

$\frac{a-x}{d}$ = weight of water displaced by the other metal.

a—b = weight of water displaced by the whole.

$$\frac{x}{c} + \frac{a-x}{d} = a-b,$$

$$\text{or } x = \frac{dca-dcb-ac}{d-c}$$

The specific gravity of gold may be taken as 19·3; of silver, as 10·4.

(6732) G. H. writes: Several times have I seen in Notes and Queries questions asked. What change must I make in simple motor of SUPPLEMENT, No. 641, to convert it into a dynamo, if I use cast iron fields? I think I have seen on two occasions where you advised not to change motor in question to dynamo, as it is not adapted for that purpose, but on no occasion have I ever seen the question asked: Why is it not adapted for dynamo? And of course naturally no answer. I must admit I am in the same predicament. I have also built the simple motor with laminated field and had perfect success. Then I changed to cast iron fields, made a new armature with 14 coils, No. 22 wire, to a resistance of 1⅛ ohms with same wire on field to the amount of resistance as a series machine, but got no results at all, not even enough to ring a bell properly. I would like to know, and per-

haps many more besides me, why it is not adapted for a dynamo. Is it on account of the Gramme ring armature, or is it because of not enough coils on armature? Of course, one reason is, as you have answered before, use finer wire on field and armature. A. The field core is too slender and long; for a dynamc a massive field is far preferable. There may be much trouble anticipated in making it self-charging. We advise you to try separate excitation of the field with a battery. Possibly you may get it started, and by connecting the field into the circuit first and then disconnecting the battery, it may keep on working. 2. What is the difference in constructing a high or a low speed dynamo and motor? A. In a motor or dynamo a strong field or an armature with many turns gives relatively slow speed and vice versa. 3. How many ohms resistance will bring current of eight light dynamo as described in SUPPLEMENT, No. 600, down to zero? A. An infinite resistance.

(6733) **Customer asks: 1. Will you** kindly define the term "an ampere hour," as applied to electricity used by a customer for incandescent lighting? A. An ampere expresses the rate of flow of current; an ampere hour means a current flowing for one hour at the rate of one ampere. The company is assumed to maintain a definite voltage. As you pay for electric energy, this maintenance of voltage supplies the factor requisite. 2. If I make an agreement with a company for incandescent light "at a price or sum not exceeding one-half cent per ampere hour by meter," what can I demand from the company—how much electric lighting for my half cent? A. You do not state the voltage. At 110 volts, one ampere hour should mean two 16 candle power lamps for one hour. If at 55 volts, then it should mean one-half the quantity. 3. If the agreement does not specify the voltage or candle power to be supplied, what strength of light in my house could I reasonably demand from the company? A. The answer to No. 2 expresses it. The voltage is always ascertainable. There is no secret about it. A very slight drop in voltage cuts down your light enormously without reducing the bills in anything like the same proportion.

(6734) **F. R. B. asks the rule for find**ing gearing for cutting threads on a screw cutting lathe. A. Read from the lathe index the number of threads per inch cut by equal gears and multiply it by any number that will give for a product a gear on the index; put this gear upon the stud, then multiply the number of threads per inch to be cut by the same number and put the resulting gear upon the screw. Example.—To cut 11½ threads per inch. We find on the index that 48 into 48 cuts 6 threads per inch, then

6×4=24, gear on stud,
and 11½×4=46, gear on screw.

Any multiplier may be used so long as the products include gears that belong with the lathe. For instance, instead of 4 as a multiple, we may use 6.

Thus, 9×6=54, gear upon stud,
and 11½×6=69, gear upon screw.

(6735) **J. L. D. asks (1) for formulæ for** finding the area of an ellipsoid or spheroid. A. If prolate, area=8·88 $r\sqrt{R^2+r^2}$, in which R represents the major and r the minor axis. If oblate, interchange R and r and apply the same formula. This may be used as a working formula. If a table of natural sines or logarithmic functions is at hand, use for more accurate work the following:

$$S = 2\pi b^2 + \frac{2\pi a b}{\varepsilon} \sin^{-1}\varepsilon$$

in which a = semi-transverse axis
b = semi-conjugate axis

$$\varepsilon = \frac{\sqrt{a^2 - b^2}}{a}$$

This is for the prolate spheroid; for oblate interchange a and b. 2. Also for the volume of same. A. Multiply square of revolving axis by the fixed axis and this product by 0·5236. These formulæ are not directly deducible from the equations named in your letter.

(6736) **T. G. asks: 1. Will electro-plat**ing with nickel or with silver affect the properties of a permanent magnet? A. No, except as the polishing or scratch brushing would impair the magnetism. 2. If not, will it be best to plate the steel before it is magnetized or after it has been magnetized? A. Plate polish, etc., at first, and magnetize afterward. 3. Can iron or steel, after being heavily plated with nickel or silver, be used in contact with wines and alcoholic liquors in general, without being affected by and without having any influence on the above liquids? A. Silver would be less affected than nickel; we should not advise reliance to be placed on the latter.

(6737) **R. W. S. asks: 1. What is the** electromotive force and the current of the common gravity battery? A. Allow 1 volt and 4 ohms resistance. The resistance is subject to wide variations according to strength of solutions used. 2. Can you give me recipe for a good depolarizing fluid for a carbon battery?

A. Water.....100 parts.
Sodium bichromate.....16 "
Sulphuric acid.....37 "

All by weight. Use the bichromate in powder. Be careful to inhale none of it in powdering, as it is very dangerous.

(6738) **R. A. C. writes: I am going to** make a storage battery; the jar will be 4 inches high, 2⅝ inches wide, and 1½ inches thick, and will be divided into four cells; each cell will contain two lead plates 4 inches long and 1¼ inches wide. Will you please tell me how long the battery will light a three candle power lamp? A. For each square inch of positive plate immersed in a single couple allow 0·03 ampere, and for each cell allow 2 volts, and ten hours running. The lamp will need 5·5 to 7 volts and 1 to 1·50 amperes.

(6739) **J. C. H says: Can you give me** formula in your Notes and Queries for cleaning smoky and dirty wall paper and leaving it as bright as new? A. To clean wall paper, rye flour and wheat flour are mixed together into dough, which is then partially cooked or baked and the crust removed. Common salt, powdered or pulverized naphthaline, corn meal, and burnt umber are then added in the following proportions: 1 pound rye flour, 1 pound wheat flour, 1 ounce common salt, ½ ounce solid naphthaline properly pulverized, 1 ounce corn meal, ½ ounce burnt umber. The composition is formed into a mass about the proper size to be grasped in the hand, and for plain wall paper, painted walls, etc., the composition should be drawn in one direction over the surface to be cleaned.

(6740) **G. E. H. writes: I have a chloride** of silver cell made by rolling a piece of commercial sheet zinc in the form of a cylinder 4 inches long and ¾ inch in internal diameter, and soldering a circular piece of zinc in one end and the cylinder down the side where the edges of the zinc meet, so as to make a watertight cell, into which is placed, after amalgamating the zinc, a cylinder of chloride of silver 3 inches long and ⅜ inch in diameter. The silver chloride is cast on a silver wire and is suspended in the cell in such a manner as to prevent it from touching the zinc and causing short circuiting. The space in the cell is filled with a weak solution of sal ammoniac and water and the end sealed with pitch. 1. Is the solder used in this cell liable to cause local action to any great extent? A. No. 2. Is 1 ampere too much current to take from this cell for a period of 5 minutes each day, and how long should the cell last at this rate of discharge? A. Yes. If you can get as much as that out of it, it will soon polarize it. Arrange a number of cells in parallel. 3. What weight of silver is required to make a cylinder of chloride of silver 3 inches long and ⅜ inch in diameter? A. About 300 grains.

(6741) **W. M. H. asks: 1. How would** acetylene answer as a substitute for the oxyhydrogen light in the magic lantern? A. It answers very well where high power is not required. It gives a very white light, but not as powerful as the oxyhydrogen. 2. If practicable, would it be better to generate the gas from the solid article as wanted or would it be more economical and satisfactory to use a cylinder of the liquid gas such as is described in the SCIENTIFIC AMERICAN October 19, 1895 (see Notes on Atlanta Exposition). A. Generate the gas from the solid article. An apparatus is described in the SCIENTIFIC AMERICAN of January 4, 1896. A very simple one is given in the SCIENTIFIC AMERICAN of March 30, 1895. 3. If the article is used in the liquid state, what is the best way of regulating the amount of gas consumed? A. Use a stopcock of first class construction, and regulate by hand. 4. Is it safe to ship it in either form on board ocean vessels, and what effect would passage through the tropics have upon it? A. Calcium carbide is perfectly safe if packed in airtight and watertight cases. The liquefied acetylene is not altogether safe under all conditions.

(6742) **H. K. W. asks: 1. Where can I** obtain a dynamo for one 8 candle lamp? A. Consult our advertising columns. Any dealer in electrical goods will supply it. 2. What power will be necessary to run such a dynamo? A. It is safe to allow ⅛ horse power. 3. Where (in what book) can I get information necessary to make as small a dynamo as indicated above? A. The SCIENTIFIC AMERICAN SUPPLEMENTS treat of this subject in great detail—giving many dynamos of various sizes. We refer you to them.

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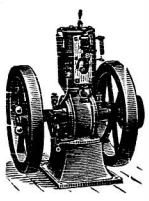

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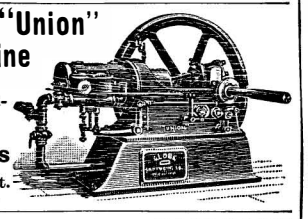

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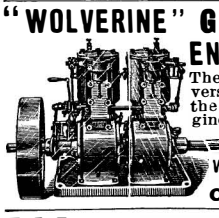

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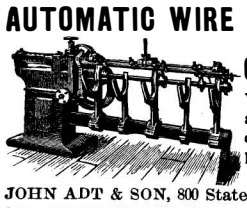

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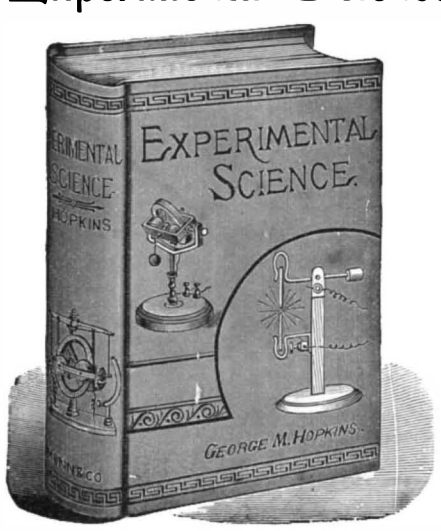

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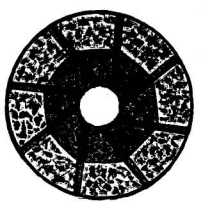

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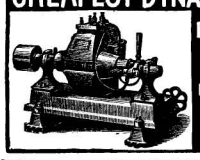

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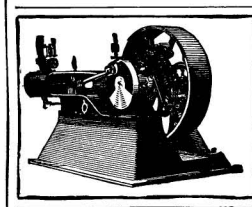

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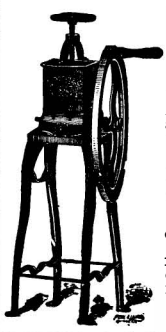

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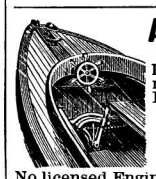

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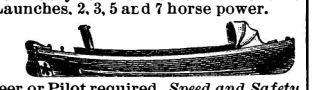

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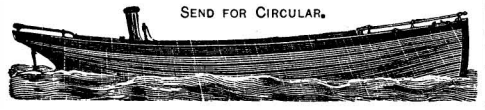

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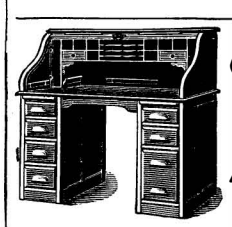

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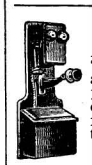

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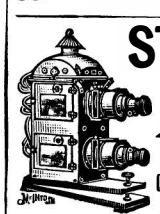

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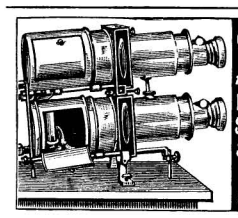

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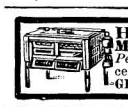

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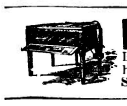

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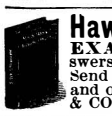

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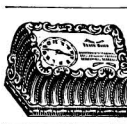

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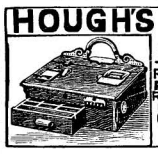

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